

SCIENCE

FRIDAY, MARCH 1, 1889.

THE ELECTRIC MOTOR IN FACTORIES.

ON Feb. 6 a visit was made to the factory of the C. & C. Electric Motor Company by the New York Electrical Society, accompanied by some of the members of the American Institute of Electrical

fact that each machine individually is in operation only for a short time, even in the busiest times of work, the sum total of the power consumed at any one time is but a fraction of that required to drive all the machines simultaneously.

Fig. 2, for which we are indebted to the *Electrical World*, gives the ampères delivered by the dynamo during the whole run of the factory for one day, the diagram shown being one selected from a

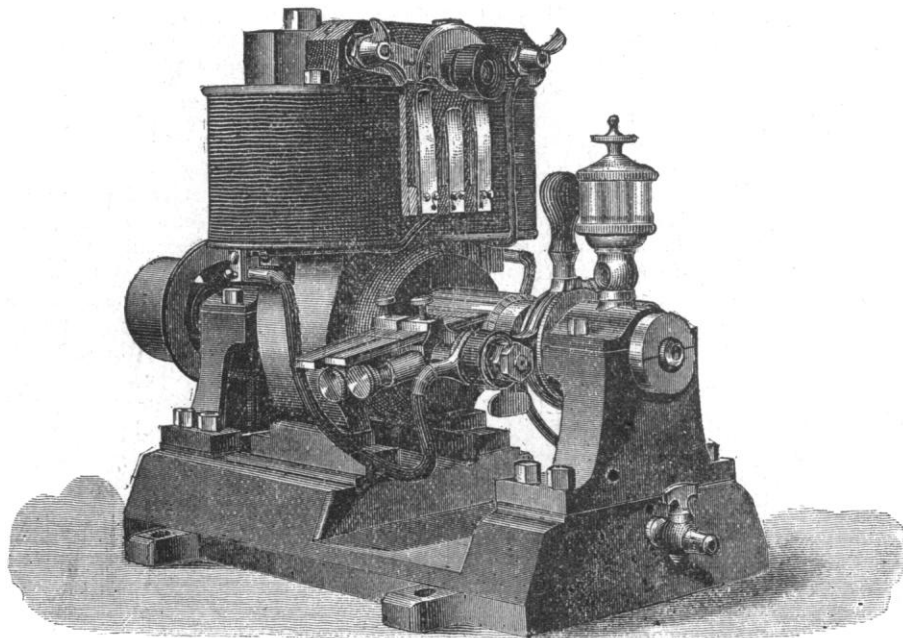


FIG. 1. — NEW TYPE OF C. & C. MOTOR.

Engineers. The arrangements for power transmission were explained by Mr. Harvey L. Lufkin, of the company.

The engine in the engine-room is belted direct to a 50,000 watt Edison compound wound dynamo, which furnishes light to the building, as well as the current for driving the motors connected with the shafting. Instead of belting from floor to floor, wires run up, connecting directly with motors suspended from the ceilings.

number which did not differ materially in outline, so that an average run is there illustrated. As will be seen, the electrical horse-power delivered by the dynamo even with the heaviest load, due in great measure to the current furnished to the incandescent lamps, never exceeded 18 horse-power; and at times of the day when little light was in demand, such as between 10 and 3 o'clock, the load averaged no more than 12 horse-power.

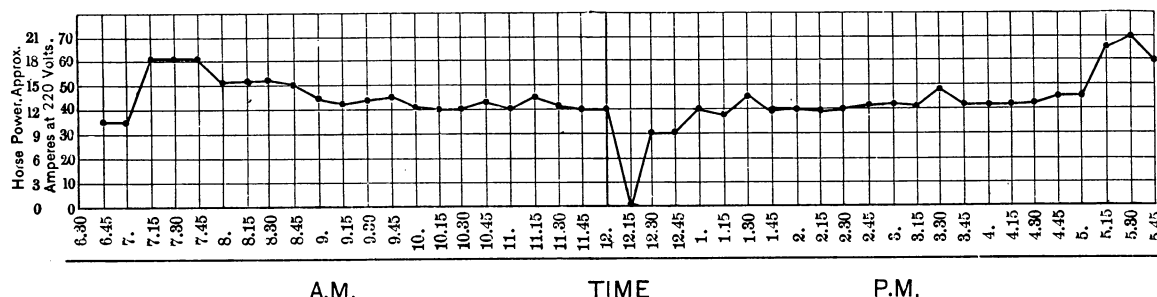


FIG. 2. — DIAGRAM OF CURRENT-DELIVERY.

On the floor working the heavy machinery, such as lathes, planers, drill-presses, milling-machines, on which are some thirty machines, four motors, connected to separate lines of shafting, do the work. Two of these are only of 3.5 horse-power, and two of 1 horse-power each. The small amount of power required is remarkable.

To one looking at the shop in operation, it seems hardly credible that machines of such small power should be capable of doing the work which is actually accomplished; but when we consider the

The average load on the dynamo is about 40 ampères, or about 12 electrical horse-power, which covers both light and power. The friction load on the engine is 6.4 horse-power, giving us a total of about 20 to 22 horse-power on the engine. The power which would be required to operate the factory in the usual way, by belting through the floors, was estimated to be between 30 and 50 horse-power, without considering the power required for lights, amounting to an additional 15 horse-power.

Every operator in the factory who has charge of a machine, be it a milling-machine or drill-press, a lathe or planer, has a certain and absolute direct and instantaneous control over the automatic valve-gear on the engine in the basement, through the medium of the belt-shifter on his machine. Suppose he is using a milling-machine. The piece being milled has finished its travel, and the machine is stopped by shifting the belt on to a loose pulley. A horse-power of duty has been taken off of the electric motor driving that machine: the tension on the motor belt relaxes to exactly that extent; the counter electro motive force in the armature of the motor instantly increases; and the horse-power of current, which is no longer called for in the motor, the dynamo in the engine-room ceases to generate; and the automatic valve-gear on the engine immediately adjusts itself to a shorter cut-off.

Another great feature in this method of factory construction is the independence of each department. A break-down in one, or a stoppage from any cause, has no effect on the other departments. Each floor is connected directly to the engine-room.

The accompanying illustration (Fig. 1) shows the improved form of motor now manufactured by the company. The motor is wound for 110 volt constant potential circuits, and is started by simply turning on the switch fastened to the front of the yoke, and stopped by turning it back again. The mechanical construction of these motors is excellent, the machine being interchangeable in every part. Every hole in each part of the machine is so drilled, even in the large bed-plate, that it is impossible for the workman to get a hole a hundredth of an inch out of the way; so that, when the machines are assembled, it is only necessary to take each piece indiscriminately out of a pile of finished parts, and bolt them together.

CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

THE ninth semi-annual convention of the National Electric Light Association was held at the Exposition building, Chicago, Feb. 19-21. The attendance was large, the electric light and power interests of all parts of the country being well represented. A large number of electrical exhibits, including all kinds of electric light and motor apparatus, from insulating tape to an electric street-car in operation, added much to the interest and importance of the occasion. The building was, as might naturally be expected, handsomely decorated, and brilliantly illuminated, when necessary, by numerous constellations of incandescent lamps, many of them being effectively grouped in ornamental designs.

On Tuesday, the 19th, the convention was called to order by the president of the association, S. A. Duncan, who introduced the city electrician, Professor Barrett, representing the mayor of the city, who was unavoidably absent. It may be mentioned here, incidentally, that a city electrician is an official undreamed of until recently, when electric light and power matters have assumed an importance approaching that of the water-supply or public works department.

After the usual courtesies of the city had been extended to the members of the association by Professor Barrett in the name of the mayor, President Duncan, after duly acknowledging the hospitalities tendered by the authorities, delivered the opening address, a brief abstract of which we give. Mr. Duncan said, in effect, —

“But few of the gentlemen of this country who are commercially connected with the manufacture and distribution of electric light and power are aware that five years ago this month a handful of men met in Chicago, and organized a movement which has grown into the organization which is in session at the present time. The industry of electric lighting at that time was carried on with all the enthusiasm which comes with a new undertaking, and with the mistakes which are sure to arise in the commercial introduction of any great industrial agency. The gentlemen engaged therein, strangers to one another, working independently, with no attempt at harmony, with but little knowledge of one another's methods of business, with no established custom or precedent to guide them, came together for the purpose of deriving those benefits which invariably result from the deliberate discussion of those questions which are common to the experience of all electric-light men. To

even enumerate the topics which have been discussed at the various conventions of this association would consume more time than your president feels at liberty to take. Fortunately, the association is in possession of a complete set of published proceedings, and these volumes testify to the steady and rapid growth of the industry, and the increased information on the part of the whole electrical fraternity on the general subject of electric light and power.

“In the early days of this association the chief question was the question of arc lighting. The incandescent light had scarcely come into commercial use. No sooner had the questions involved in arc lighting been solved than the complicated questions involved in the distribution of incandescent lighting absorbed the attention of the fraternity. Following closely upon the problems involved in incandescent lighting came the question of electrical distribution of power, first for stationary motor purposes, and afterward for the purpose of electrical locomotion. This question is, perhaps, the most important one before us. To say that electrical power is not a success would be to reflect upon the scores of electrical railways in successful operation in this country, and upon the thousands of electrical motors that are commercially serving the wants of man.

“We may here profitably consider some figures indicating the growth of the electric lighting and power industry, the increase in the number of central stations, arc and incandescent lamps, electric motors and electric railways, now in operation. At the meeting of this association one year ago, it was estimated that there were not less than 4,000 central-station and isolated plants in operation in the United States: the number of central-station and isolated plants at the present time is 5,747. This shows an increase during the year of 2,067 plants, or, in other words, of 45.8 per cent. A year ago there were 175,000 arc lamps in daily use in the United States: at present there are 219,924, — an increase of 62,625, or a total gain of arc lamps for the year of 34.3 per cent. A year ago there were 1,750,000 incandescent lamps in use in the United States: at the present time there are no less than 2,504,490, making a gain of 754,990 incandescent lamps, — 49 per cent increase. The increase in capitalization in electric-light companies of the United States during the year has been \$69,397,734.

“It is interesting to note some comparative figures upon the electric-railway industry. Six months ago there were 34 electric railroads in operation in the United States: during the last six months there has been an increase of 19, making at the present time a total of 53. Six months ago there were 83 roads in process of construction: there are 39 less at the present time, making the number of roads now under construction, not finished, 44. Six months ago there were 39 electric roads incorporated in the United States upon which construction had not yet begun: at the present time there are 42. Six months ago there were 225 electric cars in operation: since that time, 155 have been put into commission, making, at the present time, 379 cars in operation. Six months ago there were 244 cars under contract, but not in operation: this number has increased by 185 during the last six months, making a total of 339 electric cars at present under contract, but not running. Six months ago there were 138 miles of single track in operation: during the past six months there has been an increase of 157.5 miles, making a total at the present time of 294.5 miles of single track in operation. Six months ago there were 189.5 miles of single track under contract, but not in operation: at the present time there are 273.75 miles of single track under contract, but not in operation. It would be profitless to draw elaborate deductions from these figures: they tell for themselves the story of prosperity and rapid growth throughout every department of the electric light and power industry.

“We are gathered not only for the purpose of seeing an exhibit of the latest forms of electrical apparatus and supplies, but primarily for the purpose of listening to papers and discussions upon all important electrical questions. Some of the subjects deserve special mention. Petroleum for fuel first received attention from this body at its last meeting. At this meeting several papers will be presented upon the subject. The question of the materials of underground conduits in relation to the insulating materials of cables will also be treated. The question of static charge on un-

derground cables, and the attendant puncturing thereof, will also be the theme of a paper. Electric-light stations as fire risks will be treated by an expert in fire underwriting, who has given especial time and attention to that branch of the subject. Municipal lighting will be the subject of one or two papers, and no doubt of a profitable discussion. The committee on underground conduits and conductors has carried on a correspondence with the electric-lighting fraternity, and it seems proper that the information gathered should be presented in Chicago, where the undergrounding of electric-lighting wires has been more practically carried out than perhaps in any other city in the world. This question, which is at present one in which diverse opinions are held by men of equal professional standing, is one which this association cannot afford at the present time to ignore or overlook."

After some routine business, came the report of the committee on patent legislation, which shows that much progress has been made in the direction of securing the establishment of a court of patent appeals. This court is to consist of three justices, appointed by the President, with the advice and consent of the Senate, to have appellate jurisdiction in cases touching patents, copyrights, trademarks, and labels. "The expediency and propriety of, if not the necessity for, the establishment of such a court as contemplated by this measure," to use the language of the committee's report, "will not be questioned if proper consideration be given to the objects that will be attained by the passage of this bill."

It is claimed that such a court would enable the public and patentees to determine the value and validity of patents without serious and vexatious delays; that it would relieve the Supreme Court of much of the burden imposed upon it by this class of litigation; that practice in the patent office would become thoroughly fixed and understood, and the issue of worthless patents would be greatly diminished, if not entirely suppressed; and that it would tend to simplify the patent laws by construction, and settle questions of doubt which are often used by litigants for the purpose of injustice and oppression. Under the present condition of the business of the courts, it requires ordinarily from two to three years to obtain a decision in the circuit courts of the United States, and, if appealed to the Supreme Court, from three to four years are required to obtain a decision. The same difficulty and delay attend the determination of all other questions involving the determination of property rights. While this is true, it should be borne in mind that this species or character of property differs from all other kinds of property. The duration of the owner's title is arbitrarily fixed by law. The period is short, for the most part seventeen years. The Constitution imposes upon Congress the duty of securing to authors and inventors, for a limited time, the exclusive right to their respective writings and inventions. This duty is very imperfectly discharged, when, by the omission of Congress to provide proper means to determine questions arising out of patents, the life of a patent may be frittered away by the delays of the law.

The committee on insulation of wires and installation of plants being called upon for a report, it was shown that the duties of that committee were of such a character that no one engaged in the electric-lighting business would care to attempt to fulfil them: consequently there was no report to make, and the committee was accordingly discharged; as was also the committee on electrical education, which reported that Columbia College of New York had so effectively taken up the work of the committee as to render its further services unnecessary.

At the opening of the session of Wednesday, after the usual preliminary business was disposed of, the report of the underground committee was read. It contained a large number of answers to a circular issued by the committee relative to the operation of underground wires. The report was discussed by Professor Barrett, who said the underground problem was solved successfully in Chicago. Mr. W. H. Johnstone discussed the paper at length, and gave the results of experience with his own conduit, which has been laid in Philadelphia and New York. Mr. T. Carpenter Smith said that overhead wires, when well constructed, were the safest method of distribution. Mr. De Camp spoke of the non-success of running arc-light wires under ground in Philadelphia, and was joined therein by Mr. Charles Cooper and others. Mr. B. E. Sunny said that technically his underground arc wires

were successful, but their cost was very high, the expense of maintenance amounting to one cent per lamp per hour during an experience of ninety days.

The discussion induced by this report was exceedingly interesting, and made prominent the fact that many difficult problems relating to the transmission under ground of high-tension electric currents yet remain to be solved.

On Thursday, the last day of the convention, a resolution was adopted to the effect that the report of the committee on underground wires be recommitted, and three new members were added to the committee. This committee, the result of whose labors during the next half-year will be awaited with great interest, now consists of Messrs. Lynch, Barney, Kerr, Davis, Crocker, Sperry, Barrett, and Sunny.

A resolution was unanimously adopted by the association to the effect that the members of that body would decline to allow any electric current under their control to be used for the purpose of inflicting the death-penalty upon condemned criminals.

In the afternoon session the committee on insurance exchange made a report, describing the work accomplished by the New England Electric Exchange in the licensing of persons installing and operating electric-light plants, and recommending the organization of similar exchanges in every State.

Niagara Falls was selected as the next meeting-place of the association, the date to be determined by the executive committee; and the following officers were elected for the ensuing year: president, E. R. Weeks of Kansas City; first vice-president, A. J. De Camp of Philadelphia; second vice-president, E. A. Maher of Albany, N.Y.; executive committee, B. Rhodes of Niagara Falls, B. E. Sunny of Chicago, C. R. Huntley of Buffalo, Dr. O. A. Moses of New York, E. T. Lynch, jun., of Brooklyn, P. H. Alexander of New York, J. F. Morrison of Baltimore, and T. Carpenter Smith of Philadelphia.

Among the papers read at the convention were one by Mr. S. E. Barton, on "Electric Light Stations as Fire Risks," which was discussed by Messrs. Morrison, Alexander, and others; one by Mr. C. H. Rudd, entitled "Disruptive Discharges in Lead Cables," discussed by Messrs. Barrett, Lockwood, and Acheson; one by Mr. S. S. Leonard, on "Petroleum Fuel;" one by M. J. Francisco, on "Liquid Fuel;" and one treating of the "Advantages of Oil for Fuel," by Col. C. M. Ransom. The discussion of these latter papers was participated in by Messrs. Leonard, Lockwood, Ransom, and Francisco. Papers were also read by Mr. F. H. Whipple, on "Municipal Lighting," and by Mr. A. R. Foote, on "Public Ownership of Commercial Monopolies."

The interesting report of the committee on underground conduits and conductors excited a somewhat lively discussion, which was ably carried on by many of the members present. The further report of this committee at the next convention will be awaited with much interest, as the subject of putting electric-light wires under ground in our large cities has assumed great importance.

A party of sixty gentlemen, mostly electricians, visited the convention by special train from this city. The train consisted of three Pullman vestibule cars, a dining-car, and a combination car with bath-room and barber-shop. It was lighted throughout by electricity furnished by an Eickemeyer dynamo driven by a Brotherhood engine.

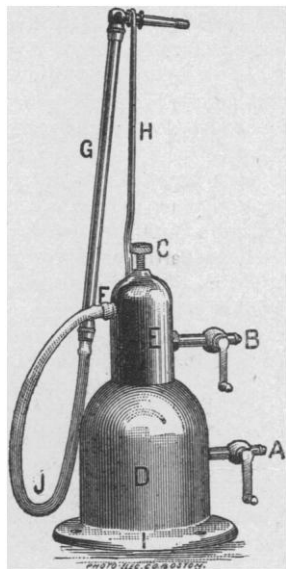
On the afternoon of Wednesday, after adjournment, a party of delegates and visitors to the convention paid a visit, by invitation, to inspect an installation of accumulators recently placed in the residence of Potter Palmer by the Electric Accumulator Company. The current is generated by one of the United States Company's dynamos driven by an Otto gas-engine. The plant works admirably, giving great satisfaction to Mr. Palmer as well as to the company which supplied it.

HARWOOD'S NITROUS-OXIDE BLOW-PIPE.

A SIMPLE and convenient form of compound blow-pipe, invented by Dr. G. F. Harwood of Worcester, Mass., is shown in the accompanying engraving. It is intended for use in scientific laboratories, technical schools, dental offices, and other places where a powerful and concentrated flame under perfect control is required.

The apparatus is so designed and constructed that it will take the necessary supply of nitrous oxide from the ordinary gasometer at low pressure, or from a gas cylinder at high pressure, and economically combine it with ordinary illuminating-gas in any desired proportion for producing and maintaining a flame of the requisite intensity.

In construction, the apparatus is simple and easily understood. It consists of an expansion-chamber or reservoir, *D*, provided with a lever stop-cock *A*, which is to be connected with the nitrous-oxide supply at the gasometer or cylinder by strong rubber tubing.



HARWOOD'S NITROUS-OXIDE BLOW-PIPE.

Above this reservoir is the mixing-chamber, *E*, with a lever stop-cock, *B*, to be connected by rubber tubing with the illuminating-gas supply. The expansion-chamber or reservoir is separated from the mixing-chamber by a diaphragm, which is provided with a regulating-valve, the stem of which projects upward through the mixing-chamber. By means of the small hand-wheel, *C*, on this stem, the admixture of the two gases may be perfectly controlled. The combined gases are conducted through the outlet *F*, and flexible tubing *J*, to the blow-pipe tube *G*. This tube is provided with interchangeable nozzles, by means of which either a large or a small flame may be secured. When not in use, the nozzle is supported by the curved wire standard *H*. The flange *I* is drilled for screws, by which the apparatus may be secured in any convenient position to the wall or to a shelf or bench.

BELLITE.

ON Tuesday, Feb. 5, a series of experiments were made at Chadwell Heath, England, with the new explosive, bellite, invented by Mr. Carl Lamb. A description of these experiments is given in *Engineering* of Feb. 8, 1889. Reference is also made to this explosive in the same journal for July 1, 1887, and in that for Nov. 9, 1888. The new series of experiments were fully as successful as those described in these articles, and the absolute safety of the new explosive has now been placed beyond cavil. The experiments were arranged in groups, each of which was intended to illustrate either a distinguishing characteristic of bellite or its adaptability to some specified end. The first experiment was intended to exemplify its use in submarine mining: 1½ pounds of the material was enclosed in a tin canister, and, on being fired by a detonator, the explosion sent the spray fully 150 feet high. The next group of experiments were made with the object of showing the perfect safety of the material, and that it could only be fired by a detonator. A bellite cartridge was broken in two, and one half thrown on a fire, where it slowly burnt away with a reddish flame: the other half, weighing about 2 ounces, was then exploded on a wrought-iron plate 12 inches by 12 inches by ⅜ of an inch thick, the charge being tamped with clay. The shock bulged the plate to a

depth of about 2 inches, but did not pierce it. An even more convincing proof of its safety was afforded by the chairman of the company, who, holding part of a naked bellite cartridge in one hand, calmly applied a lighted fusee to the fragment with the other. The bellite charred and smouldered, but went out immediately on removing the match. The next experiment was a repetition, on a somewhat smaller scale, of one of the Middlesbrough experiments, described in the second of the articles quoted above. An iron weight, weighing 120 pounds, was dropped from a height of 18 feet on to a number of naked bellite cartridges supported on an iron plate. The test was repeated twice, as on the first occasion the weight fell somewhat to one side; but on the second trial, with more careful centring, the mass of bellite was crushed to a powder. This test was much less severe than the Middlesbrough one, when the weight was half a ton, and fell from a height of 20 feet; but a heavy weight of this character is not easily moved from place to place, and hence the reason for the lighter one. A small canister capable of holding 5 ounces was then filled with the fragments resulting from the last experiment, and laid on the web of an old Great Eastern Railway Company's steel-faced rail, the charge being slightly tamped with clay. On firing, the rail was snapped in two, a piece about 1 foot long being flung 6 yards, and smaller fragments much farther, while a pit 15 inches deep was sunk in the ground immediately underneath the position of the charge.

The next experiment was a repetition of one first made at one of the collieries of South Wales. In it 1 pound of ordinary blasting-powder and 1 pound of naked bellite cartridges were placed together in an open pit 1 foot 10 inches deep, and the powder ignited. Some pieces of the bellite were thrown out of the hole, and all were slightly charred, but none of it exploded.

To further illustrate the safety of the material, a fragment of bellite was fired from a large-caliber gun (No. 8) with two drams of powder, against an iron plate, without any explosion of the bellite occurring either in the bore of the gun or on striking the target. This experiment would, moreover, seem to prove that bellite is well adapted for use in shells, and the English Government is accordingly to be congratulated on not having spent large sums in acquiring the secret of melinite. It had been the intention of the experimenters to fire a bullet from the same gun at a target formed of bellite cartridges backed by an iron plate; but, owing to the jamming of a cartridge in the gun, this experiment had to be abandoned.

To compare the effects of bellite with those of dynamite, 2 ounces of each explosive were fired on wrought-iron plates measuring 12 inches by 12 inches by ⅜ of an inch thick; each plate, with the object of rendering the conditions as uniform as possible, being supported above the ground by a narrow cast-iron ring about ⅝ of an inch thick, 3 inches high, and 11 inches internal diameter, the charge in each case being tamped with clay. Both plates were pierced through, but the rents in the one on which the dynamite had been fired were considerably larger, while, on the other hand, the bulge in this plate was only 2½ inches deep, as compared with 3 inches in the case of the other, thus showing the action of the dynamite to be more local.

The next series of experiments were made with a view to showing the adaptability of bellite to military purposes. To this end the ballistic properties of bellite and Curtis and Harvey's rifle-powder were first compared; a 6-inch ball, weighing 32 pounds, being fired from a mortar, first with ½ ounce of powder, and, second, with ¼ ounce of bellite, the weighings being carefully made in the presence of two representatives of the press. With the powder, the ball was thrown a distance of 40 yards 1 foot; and with the bellite, to a distance of upwards of 100 yards, the penetration into the ground being also much greater in this case.

Two mines had been prepared, one with 6 pounds of powder laid at a depth of 5 feet, and the other with 6 pounds of bellite laid at the same depth. In trying to explode these, however, it was found that in the passage of some of the spectators over the mine both fuzes had been pulled out from the bellite charge, and the attempt to fire it accordingly failed. A good idea of what the effects would have been was, however, gained in the next experiment, in which a mine containing 8 pounds of bellite was fired underneath a length of railway laid down for the purpose. The explosion smashed both

rails clean through, and several of the sleepers were splintered, a large piece of one being flung fully 40 yds, while the crater formed was upwards of 12 feet in diameter. This, the most striking of the experiments, was also the last.

SCIENTIFIC NEWS IN WASHINGTON.

Bibliography of the Iroquoian Languages. — The Los Angeles Base-Line. — Deep-Sea Models.

Bibliography of the Iroquoian Languages.

SOME ten years ago Mr. Pilling of the Bureau of Ethnology entered upon the formidable task of preparing a systematic and exhaustive exhibit of all printed and manuscript works giving information respecting the speech of the native races of North America. The need of such exhibit had become strikingly apparent. For nearly four hundred years information had been accumulating respecting the North American aborigines, and this accumulated information had been printed in many lands in many tongues. The subject was fast becoming, or had already become, buried in the *débris* of its own literature. Special students found themselves consuming an inordinate amount of time in acquiring even an imperfect knowledge of the literature of the special subject of their study.

Recognizing this condition, the labor of preparing a bibliography of North American linguistics was, as already indicated, systematically entered upon more than ten years ago, and has been continued with only such interruptions as were necessitated by other official duties. The work before us¹ closes the third chapter in this work.

The first chapter or division of the work was a bibliography of the Eskimo languages, issued in 1887; the second, a bibliography of the Siouan languages, issued in 1888; and the third, that of the Iroquoian, now before us; to be shortly followed by the Muskogean, and later by the Algonquian and the Athabascan.

The aim to make the catalogue as exhaustive and complete as possible, and the dictionary plan of arrangement, carried to its extreme limit, remain the same as in the earlier bibliographies; and it may be added, that zeal in the pursuit of all information relating to the books catalogued, and fidelity in exhibiting this information, increase rather than diminish as time passes.

As a sample of Mr. Pilling's painstaking bibliographic research, the "Voyages of Baron Lathontan" may be cited. Seven pages of the bibliography are given to the careful and minute description of the eighteen editions of the work, which appeared in French, English, German, and Dutch. To collate these different editions, copies were borrowed from numerous sources, and photographs of titlepages made, that proof might be read from facsimiles. The careful scrutiny exercised in preparing these minute descriptions has developed the fact, that, from the original edition of 1703, two spurious editions of the same date were prepared. So far as ascertained, but one copy of the authentic edition is extant.

The catalogue contains in round numbers 950 titles, of which 800 relate to printed and 150 to manuscript matter. Of these, Mr. Pilling has himself seen and described 850, or 89 per cent; and of the remaining 11 per cent, about two-thirds have been seen and described for this catalogue by his correspondents. Thus about 95 or 96 per cent of the entries are at first-hand; and, further, 61 per cent of the entries were compared directly with the original sources while the proof was passing through his hands.

Of the various languages included under the general term "Iroquoian," — viz., Cayuga, Cherokee, Hochelaga, Huron, Iroquois, Maqua, Minqua, Mohawk, Oneida, Onondaga, Seneca, Tuscarora, and Wyandot, — more than half of the material catalogued relates to the Cherokee and Mohawk only; most of the Bible, for instance, having been printed in each of these languages. Printed dictionaries of the Huron, Mohawk, and Onondaga, and manuscript dictionaries of the Seneca and Tuscarora, are in existence. There are in print rather extensive grammatical treatises on the Cherokee, Huron, and Mohawk, and fragmentary grammatical notes on several of the remaining languages. Of the Cherokee texts, all except two spelling-books, published in 1819 and 1824 respectively,

are in the Cherokee syllabary, these two having been printed before the invention of those characters.

The earliest printed record of any North American language appears to have been made by Cartier, whose first voyage was made in 1534, and the second in 1535. There is reason for believing that the original account of the first voyage contained a vocabulary of the people of New France; but, so far as known, no copy of this book is in existence, and the date of its publication is not known. The account of the second voyage was published at Paris in 1545, and contains a Huron vocabulary.

This is one of the rarest books in the entire list, only two copies having been known for the last three hundred years. Of these, one was bought in 1851, and lost in a ship on its way to America. The other and only known copy is in the British Museum. Of this "unique," Mr. Pilling gives a facsimile of the titlepage. Facsimiles are also given of several other rare, curious, or specially interesting books.

The work contains eight pages of addenda, which accumulated while the copy was in the printer's hands.

A chronologic list of authors at the end of the volume, covering eighteen pages, begins with Cartier in 1545, and ends with a list of nearly forty works issued in 1888. From an inspection of this list, it appears that interest in matters relating to the Iroquois was never greater than at present; and, while the literature of the subject has been accumulating during the past three hundred and forty years, more than half of it has appeared within the last forty.

The Los Angeles Base-Line.

The "Yolo Base," as it is familiarly known to geodesists, being the base-line measured in Yolo County, Cal., in 1881, for the trans-continental triangulation of the United States Coast and Geodetic Survey, was, in point of rapidity and accuracy of measurement, the best work of the kind ever performed. That measurement was made under the immediate supervision of Professor George Davidson, assistant United States Coast and Geodetic Survey, with the five-metre compensating base apparatus, which had been constructed at the office of the survey in Washington, under the supervision of Assistant C. A. Schott, and in accordance with a design prepared and submitted by him. The length of the "Yolo Base" was 17,486.5119 metres (10.86 miles). It was measured twice throughout its entire length, with a third measurement covering less than half (42.8 per cent) of its length. The two measurements and partial measurement occupied a total of forty-six days.

The recent measurement of a Coast and Geodetic Survey base-line near Los Angeles, Cal., which was concluded on the 16th of February, afforded to Professor Davidson, under whose supervision the work was also done, an opportunity of fulfilling his announced purpose of "breaking all records" of base measurements.

The "Los Angeles Base" is roughly 17,496 metres in length, or 9.5 metres longer than "Yolo Base." Although the weather was extremely unfavorable, the work having been pushed in the frequent severe rain-storms, which converted the line into a route of deep mud, standing pools, and rushing streams, three full measurements were completed in 46.75 days, the average measurement per day having been 1,122.73 metres, against an average of 912.5 in the "Yolo Base;" the longest measurement in a single day having been 2,000 metres, against 1,620 metres on the "Yolo Base;" and the cost, exclusive of the expenses connected with the establishment of monuments at the ends of the lines, was \$8,000, against \$15,578 for the measurement of Yolo.

It is hardly to be expected that the accuracy of the Yolo measurement, which involved a probable error of ± 0.035 of an inch per statute mile, or .38 of an inch in a length of 10.8657 miles, will be surpassed by that of the Los Angeles Base. If it is even equalled, the Los Angeles Base measurement will signalize again the unequalled proficiency of American officers.

Deep-Sea Models.

Mr. E. E. Court of the Hydrographic Office of the Navy Department has published two excellent models, — one of the Atlantic Ocean, the other of the Caribbean Sea. These accurate and neatly finished models convey an excellent idea of the configuration of the bottom of the sea which is only inadequately expressed to the in-

¹ Bibliography of the Iroquoian Languages, by James Constantine Pilling.

experienced eye by means of contour-lines. Therefore these models have a highly educational value, and will be used to the greatest advantage in the teaching of geography. One of the features most strikingly shown in the model of the Atlantic Ocean is the extent of the continental shelves both of the Old and of the New World. The abruptness with which oceanic islands rise from the greatest depths is also well shown. The deep valleys of the Gulf of St. Lawrence, of the Florida Strait, south of Cuba, and at the mouth of the Kongo, appear very distinctly and clearly, and the bold relief of the Mediterranean Sea is seen to be in striking contrast to the oceanic depths. The undulations of the ocean are shown not less clearly. The great transatlantic cables are shown. Mr. Court deserves the thanks of teachers of geography for having undertaken a work of this magnitude. As the prices are very reasonable, — being ninety dollars for the model of the Atlantic Ocean, and seventy dollars for that of the Caribbean Sea, — it is to be hoped that universities and colleges will possess themselves of these valuable works. The author has also published photographs of these models, which show the relief to good advantage, although of course not as clearly as the models themselves.

HEALTH MATTERS.

London, Ancient and Modern, from a Sanitary Point of View.

IN *Nature* of Feb. 7 is an abstract of a lecture delivered by Dr. G. V. Poore at the Sanitary Institute on Thursday, Jan. 24. Dr. Poore began by reminding his hearers that the mere age of London was one of the reasons why it became unwholesome. Roman London was buried deeply among rubbish of all kinds, much of which was putrescible, and therefore a source of danger in the soil.

Ancient London was well placed, and magnificently supplied with water, for, in addition to the Thames, there were many streams, such as Westbourne, Tybourne, the Fleet River, Walbrook, and Langbourne, which originally were sources of pure water. All these brooks, however, had become disgracefully fouled, and for very shame had been covered over. One great drawback to the site of London was the proximity of marshy land on every side except the north-west, and formerly from this cause malarial fever and dysentery were great causes of the high death-rate.

In mediæval London, and even down to the eighteenth century, the houses were not so closely packed as they are now. Reference to Aggas's map (time of Elizabeth) would show that there was a great deal of garden-ground within the city; and, on comparing this map with Newcourt's map (Charles II.), it was evident that just before the Plague and the Fire the crowding of houses had become very much greater than it was in the time of the Tudor monarchs, who discouraged building near or in London.

Parker's map (1720) would also show that after the Fire the houses were not so closely packed as in the days of the Stuarts, for in this map a surprising amount of garden-ground is visible within the walls. At this time, also, Moorfields was not built upon, and remained as a playground and air space, as it had done for centuries previously. That mediæval London was very unhealthy, a perfect fever-den, there could be no doubt. The Black Death in 1349, and the Sweating Sickness two centuries later, were times of great mortality which struck the popular mind; but it was not till 1593, when bills of mortality were first introduced, that we began to have any certain knowledge of the amount or the kind of disease prevalent. There was reason to think, however, that in the eighteenth century (after the Fire and the Great Plague) the deaths exceeded the births by about 600,000 in the hundred years.

The fatal diseases were mainly malarial fever, small-pox, typhus, measles, and (latterly) whooping-cough. The causes of the enormous mortality of mediæval London were due (1) to the marshy undrained soil, fouled with refuse of every kind; (2) the filthy state of the unpaved city, and a perfectly swinish condition of the houses of the lower orders; (3) the ill-nourished and drunken condition of the masses, among whom a taint of scurvy was very common; (4) the condition of superstition and brutality (as evidenced by the punishments and the pastimes), which made any measures of public health impracticable; (5) the bad management of epidemics, with a total neglect to separate the sick from the sound; and, finally, the

medical faculty were scarcely less ignorant and superstitious than their patients.

Turning to modern London, the lecturer said there had been a great and manifest improvement; but, when we looked at the low figure which is called the London death-rate, several things must be taken into consideration: e.g., (1) the London of the registrar-general included large districts, such as Lewisham, Wandsworth, Fulham, etc., which, in great part, were scarcely urban in character, and these, being occupied largely by well-to-do persons, lowered the average death-rate for the whole city; (2) London being a city in which wealthy people abounded, its death-rate must not, in fairness, be compared to a city packed with undiluted operatives; (3) the mobility of the population was so great, that this fact must vitiate the statistics, and it was to be remembered that nothing quickened the departure of an individual from London more than ill health; (4) the age distribution in London was very abnormal, it was largely recruited by selected adults from the country, and there was a great deficit in the extreme ages, among which (the very young and very old) death-rate is always highest; (5) again, the diminishing birth-rate (that for 1887 was 2.8 below the average of the previous ten years) very greatly diminished the death-rate in a city where 158 children out of every 1000 born die before they are one year old.

It was difficult to believe that Londoners were very robust, when more than 25 per cent of them had recourse to the public hospitals in the course of the year.

The cause of the diminished death-rate (which was very considerably reduced after every allowance had been made) was due (1) to the increase of knowledge, not only among doctors, but among the people generally, for it must be remembered that "self-preservation is the first law of nature;" (2) vaccination, and the modern plan of treating infectious diseases by the prompt separation of the patients, had done a great deal (the total absence of small-pox and typhus were mainly due to these causes); (3) the cheapness of food, clothing, and fuel, had, of course, diminished the tendency to disease, and the ease with which fresh fruit and vegetables were to be got had abolished the taint of scurvy which was so fatal to previous generations; (4) the water-supply had been improved, and the intake of the water companies was now removed to a portion of the river less tainted with sewage than that formerly in use; (5) although the system of sewage-disposal was an undoubted evil, and had caused three or four epidemics of cholera, and was the foster-mother of typhoid, still it was probable that so far the balance for good was in its favor, because it had removed a good deal of filth from dwellings.

The outlook in the future was dashed by three considerations: (1) The system of sewerage and water-supply had increased overcrowding by enabling houses of any height to be built without inconvenience to the occupant, and without any curtilage whatever; and, since all sanitarians recognized that overcrowding was the greatest of all sanitary evils, it was impossible to shut one's eyes to this danger. (2) There was an expensive and menacing "loose end" to sanitation in the shape of 150,000,000 gallons of sewage pouring into the Thames every day. The only proper destination of organic refuse was the soil, and it was not possible to see the end of the gigantic blunder that had been committed in throwing it into the water. (3) The rapid increase of population along the valley of the Thames, where sewage-disposal is on the same lines as in London, must make the English apprehensive for their water-supply, because the various tricks played with sewage in the shape of precipitations, etc., were not probably of a kind to make the effluent a desirable or a wholesome beverage. If the evil effects of free trade are to be counteracted, it will be by returning the refuse of towns free of cost to the impoverished agriculturist. "If we go on as we are going," said the lecturer, in conclusion, "and if our brethren in the colonies follow our bad example, as they appear to be doing, it will be a Chinaman rather than a visitor from New Zealand who will sit in contemplation on the ruins of London Bridge."

LARGE deposits of lead and silver ores and coal have recently been discovered in the district of Kouban, Russia, on the Black Sea.

ETHNOLOGY.

The Races of Egypt.

IN the spring of 1888, Professor R. Virchow visited Egypt in order to inquire into the physical character of the Egyptians, his special object being to study the influence of the climatic and other conditions of the country upon man, and the other question, to compare the type represented on ancient monuments with that of the present inhabitants. Far-reaching conclusions have been made from studies of ancient paintings and carvings, but so far no sufficient anthropological basis existed for these studies. From this point of view, Virchow's work is of special interest to the ethnologist. The "Proceedings of the Royal Geographical Society" contain a full report of Professor Virchow's observations, from which we glean the following notes. The author says, that, although a final and satisfactory solution of the question is not yet to be expected, the solution of it in the case of Egypt is of great importance, because in that country the oldest historical data have made us familiar with men of the most highly developed civilization, who, through the position of their habitation,—an island in the sea of desert,—appear, in the most remote times, to have been shielded from foreign influences. At the time of the most ancient historical king of upper Egypt, King Menes, who reigned about the year 6000, we find a people with all the arts of civilization, an elaborate state system, a complete hierarchy, famous monuments of architecture and sculpture, and the rudiments of painting. But what was the state of things before the time of Menes? Here the threads of history break off short: the prehistoric period is filled up by later Egyptian and Grecian writers by means of a promiscuous collection of legends and myths, of which the student can take no account; although Professor Lant of Munich has endeavored, and not without success, to extract a reliable historical kernel out of the myths. Since 1869, positive data have been continually collected, and the result is to show that there has been an Egyptian stone age. But between the latter and the age of Menes, which presents the arts of civilization in complete form, there exists a yawning gap; and we seek in vain for a connecting link between any one of the oldest temples near the Sphinx, which itself presents no inscriptions and decorations of the later age, and the period of the stone age. As to the conventionalism of Egyptian works of art, we know now some details.

The supposition which was long held, that the ancient Egyptians at the time of Menes correspond with the type of man to-day existing there has been shown to be erroneous. Since the mummies of the old Egyptian kings, such as Sesostri, Settri, Rameses, and others, were discovered in 1870, and the crania of these conquerors have furnished us with measurable data, it can be asserted with safety that the existing images and statues of these rulers are not portraits, but that the latter were fashioned according to a certain conventional design. We are not, however, in the same position with regard to the sculptures of the older dynasties. Of these we only find scanty remains. Some crania, authenticated, but partially covered by inscriptions, are the only relics which we possess of that earlier time; viz., from the fifth dynasty backwards. With these, however, the statues agree. They are the skulls of short heads, while the fellaheen of to-day have long heads. This, then, at least, may be taken as settled,—that a change of type in the case of the dynasties has taken place. The case is otherwise with regard to the ethnological figures on the Egyptian works of art which are represented beside the king. These show that in the oldest historical times the different types of people, which we find up to this day in Egypt and the neighboring countries, were just as sharply distinguished from each other as they are now. The question in this case, however, is not about portraits, but about types, in which the essentials (such as the kind of hair, form of head, etc.) remain the same, while the externals (the armor, clothing, etc.) change according to the periods. The oldest representation of a negro is found in the tomb of Una, one of the kings of the sixth dynasty. In the opinion of many, especially of Lepsius, the territory situated between the first and second cataracts, between Assuan and Wadi Halfa, which is the true Nubia or Ethiopia, is the district where the change of the Central Africans into the Egyptians took place. It is the same region which for four

thousand years, down to the present time, has been the object of strife between the northern and southern races. In the oldest times the country which lies immediately south of Assuan was called Kash (the biblical Kush). Lepsius tried to prove, from considerations of language, that the inhabitants of Kash were negroes. The investigations of Professor Virchow on the spot, however, have resulted in establishing the contrary. The Nubians have, in skin, hair, or shape of head, no racial connection with the Nigritians, who are pure negroes. The Nubians, or, as they call themselves, the Barâbra (Berbers) have to look for their kinsmen in the north, and not in the south. The Bedouins of the eastern deserts, the Bisharin and the Ababde, resemble them very much. As regards constancy of types, it is sufficient that no noteworthy changes have taken place within historical times. One of the most important anthropological characteristics is the color of the skin. In the case of the Nigritians, this is practically independent of all external circumstances; air and light have no effect upon it; the negro remains black. Among the northern inhabitants there is an important variability of coloring. Light and air exert a considerable influence upon the color of the skin of the Egyptian and Bedouin. The people of southern Europe also become dark in Nubia, but grow pale again when they return to the north. This fact furnishes the explanation of the diversity of coloring found in the old Egyptian pictures, which were painted according to certain rules, and in which the men appear always dark red, and the women light yellow. The prime color of the one is vermilion, and of the other orange. The former characterizes the man working out in the open air; and the latter, the woman working in the house, and thus preserving her light skin color. Greeks of the third generation living in Nubia have to-day a completely Kushitic appearance. This changeability of the color of the skin characterizes all the peoples as far as Dongola, where the Nigritians first begin, and forms the principal basis for the theory that the north and south of Egypt never belonged to each other ethnologically, and that the northern races of Egypt did not spring from negroes. The direct anatomical proof for this assertion cannot, it is true, be adduced, inasmuch as prehistoric skulls have not been found. Craniological studies point to the near relation of the Egyptians of to-day to the Berbers of Morocco and the Guanches of the Canary Islands.

DICULAFOY'S EXCAVATIONS AT SUSA.—One of the most important archæological expeditions undertaken in western Asia is that of M. and Mme. Diculafoy, who were sent by the French Department of Public Instruction and of Public Works to Media and Persia to explore the remains of the ancient cities of these regions. Their first expedition was undertaken in 1881 and 1882, and their work was completed in the years 1884, 1885, 1886. The excavations, which were carried out with great difficulty, on account of the fanaticism of the inhabitants, have yielded valuable results from an archæological as well as from an historical standpoint. The palaces of Artaxerxes and of Darius have been excavated, and it is now possible to reconstruct the plans of these magnificent buildings. The objects collected during these excavations have been transported to Paris, and form one of the most interesting departments of the new galleries of the Louvre. The collections contain polychromic bas-reliefs from the royal palace, representing lion and warriors, and potteries of the first or second century of our era. Besides architectural remains, numerous inscribed cylinders, ivory, bronze, and clay objects have been found. The palace, a model of which is being made, was a magnificent building rising on a platform sixty feet in height, protected by walls, and accessible only on the south side by a large staircase.

ETHNOLOGICAL COMPARISONS.—There are two methods of studying ethnology,—one by studying the growth of a single culture, the other by comparing isolated phenomena among a great number of tribes. While the former yields results of historical interest, the second is of prime importance to the student of psychology, who investigates the laws of the growth of human thought. R. Andree, who has for a long time continued the latter course of studies, has collected a series of essays on "ethnological parallels," most of which have previously been published in various journals. One of the most important results of such comparisons is the conclusive evi-

dence that many similar customs must have originated independently in regions far apart. Among many other phenomena, the author traces the occurrence of masks among various peoples, and shows that they occur all over the world, in America as well as in Australia and all parts of the Old World. It seems that the games in which our children delight are well-nigh universal. The children of the ancient Egyptians played tag; they had balls and dolls. Bodies of dolls were made of wood, and might be mistaken for modern fabrics. Undoubtedly they were dressed by the Egyptian girls, as our girls nowadays enjoy dressing their dolls. There were even movable ones, the hands and feet of which could be moved by means of strings. Others, made of painted wood, were very imperfect in form, and had strings of beads instead of hair. In the museum of Leyden there is an ancient toy that looks as though it had been bought at a Christmas fair. There were figures of animals with movable mouths, and balls of leather. Among Greek and Roman antiquities, dolls made of wood or clay, and others of wax and ivory, are found. Dolls' houses with lead furniture; the saving-box with a slit on top; toy cows, horses, and hogs, — were known to the children of ancient Rome, as they are to our own. From this evidence it might be supposed that our dolls are "descendants" of the ancient dolls; but it must be remembered that there is hardly any people that does not have them. Their use is so general, and so natural to the child, that even the laws of Mohammedanism are disregarded by the childish desire. The Koran forbids representations of human beings, and still the Mohammedan child plays with its doll. The women of Bagdad believe that a doll may eventually come to life, and harm their children, and therefore prevent their use. The girls, however, play with cushions and pieces of wood instead, which they nurse and dress. In Siberia and arctic America ivory dolls, clothed in furs, of beautiful workmanship, are found; in Peruvian graves, dressed dolls of clay are found; and in Africa the girls play with wooden or clay figures. In this way Andree traces numerous ethnological phenomena in their distribution among various peoples, and shows that the human mind everywhere develops on the same lines, and that a migration of inventions must be supposed only in such cases where its existence can be proved by historical facts.

ELECTRICAL NEWS.

Ether, Electricity, and Ponderable Matter.

SIR WILLIAM THOMSON'S presidential address before the English Institute of Electrical Engineers was looked forward to with some eagerness by electricians. The title given above is fascinating, and promises solutions of questions which have been asked for so many years, and whose answer had seemed so hopeless. We think that the address is disappointing. It tells us little that we did not know, and, although suggestive, it hardly points out how to follow the suggestions.

After a few introductory remarks, Sir William dwelt briefly on the necessity of an electrician being also an engineer. He would give a youth desiring to take up the study of electrical engineering a good deal of chemistry, of mathematics, and of dynamics. "I am perfectly sure, that, if the youth is qualified in other departments, the mere addition of electricity to the education of a competent engineer will not take such a long time as might be imagined, and that the merely educational part of the work will not be protracted unduly by adding electricity to the branches learnt in general engineering."

Passing to the main subject of his address, Sir William spoke of the demand that was every year growing in intensity, for something like a mechanical explanation of electrical phenomena: "to know something of the internal relations connected with the wonderful manifestations of force and energy which are put before us in the action of the magnet, in the working even of a common electrical machine, and in electro-magnetic phenomena." The question of the transmission of messages through cables was then taken up at some length, and the history of the theory on which the first Atlantic cable was constructed was given. Sir William then spoke of the two effects which must be considered when an electrical wave is transmitted, — that due to static induction, and that due to magnetic induction. In the first solution of the problem, only the

statical effects were considered, since the propagation was so slow that they were large compared with the magnetic effects; but Mr. Heaviside has lately shown that the magnetic induction is really an advantage in signalling or in transmitting speech by telephones, since it makes the dying-out effects much more uniform. If only static induction were considered, the waves of short period would die out more quickly than those of greater length. The magnetic induction helps to make this difference less, and is therefore beneficial.

Taking up the subject of alternating electric currents in wires, the speaker gave some figures on the increase in the resistance of a wire carrying alternating currents as compared with the resistance of the same wire for continuous currents. It has become well known in the last few years that the distribution of a varying current in a wire is not uniform, but the density is greatest near the outside. This has the effect of increasing the resistance: for instance, taking a period of 80 reversals per second, the increase in resistance of a wire 1 centimetre in diameter is not so much as .01 per cent; for a diameter of 1.5 centimetres the increase is 2.5 per cent; for 2 centimetres it is 8 per cent; for 4 centimetres, 68 per cent. For periods of twice the frequency we must multiply by $\frac{1}{2}$. The inward penetration of the current into the wire may be compared to the motion of water in a long tube, when the tube is moved backward and forward in the direction of the axis. To represent the case of alternating currents in parallel wires, Sir William would replace the wires by densities of fluid in direct proportion to the electric conductivities, the space around being a fluid without mass, the cylinders of dense matter rotating periodically in opposite directions. To represent the electro-static effect in such a case, "imagine an interface between the two fluids, and give it such stiffness against change of shape as is required to cause it to fulfil the conditions which electro-static knowledge, and our knowledge of the laws of electric and electro-magnetic influence, dictate to us."

Sir William then went on to say that he believed that an electric current actually caused a rotation of the ether, and considered the case of a copper core surrounded by a helix. Induced currents were set up in the copper, and the only action conceivable in the space between the coil and the core was a rotation. This might be either a continuous rotation, or a rotation through an angle proportional to the strength of the current. In iron, however, something quite different must take place. If the fluid whose rotation caused the observed effects moved around continuously, there would be no shearing. If, on the other hand, there were only a drag upon the ether through a certain angle, then there must be a force resisting steady rotation; that is to say, there would have to be an arrangement of such character that a constant torque would produce a constant instead of an accelerated rotation. It would appear that such an effect could only be produced by an inherent rotation of the molecules. To represent a medium of this kind, Sir William imagines a space divided up into a number of small squares, with their sides fixed together by rubber bands. In each a gyrostat in the form of a rotating molecule is placed. Such a medium, without the gyrostats, would represent a perfect fluid; but, with the gyrostats in place, turning could only take place by stretching the elastic bands, which would require a constant force. On this hypothesis, we must suppose that the ether is less rigid in iron than in other metals, and has the same rigidity for all non-magnetic substances. But no model that can be imagined can represent the electro-static as well as the magnetic effects. In concluding, Sir William pointed out that even the very imperfect attempts at a mechanical explanation of electrical phenomena which he had indicated would only apply to a very small part of the subject; and the tremendous difficulties in the way of a complete mechanical explanation prevented him from hoping to see the question solved in his own lifetime, though he felt confident that a solution would be found, and that what appeared so insuperable a mystery to us would be no mystery at all to future generations.

AN ELECTRIC DATE STAMP. — According to *Engineering*, the Electric Date and Time Stamp Company are introducing a new stamp, which at one operation marks on any document the minute, hour, day, month, and year, as well as the usual address and business of the proprietor. Unlike many automatic appliances which are dubbed electrical merely for the purpose of imposing on un-

wary customers, the electric current is really employed in this piece of apparatus. The device consists of five type-wheels with connecting gear, disposed on a single axis; and the minute, the hour, the day, the month, and the year are correctly placed in line under the impression-pad. The minute-wheel is actuated by any clock, through the instrumentality of an electric current, which shifts it round minute by minute, a pawl carrying round the hour-wheel when sixty movements have been made. The apparatus is under trial at the London General Post-Office for dating telegrams.

THE PRODUCTION OF ELECTRIC CURRENTS BY MECHANICAL ACTIONS. — The following interesting experiment is due to M. Siljestroem. Two hollow iron cylinders were closed at one end by the same plate of german silver, and were plunged in ice. They were connected with a galvanometer, and, when the air in one of them was compressed to 86 atmospheres, a current was observed which was in the opposite direction to that which would be produced by an elevation of temperature, although there was a momentary current in the same direction as the latter.

EDISON ILLUMINATING COMPANIES. — The development of the electric-light business is well shown in the holding in Kansas City, on Feb. 12-13, of the semi-annual convention of the Association of Edison Illuminating Companies, a full report of which appears in the *Electrical Review*. The Edison meetings of this kind have invariably been for "business." The policy of President John I. Beggs has always been to hold the convention closely to its work up to the final adjournment, leaving the question of recreation as a secondary consideration. The convention, while not as large as on former occasions in the number of delegates in attendance, was one of absorbing interest, the papers were more numerous and comprehensive than at previous meetings, and there was nothing lacking in the discussions of the vital features of the business with the exception of the unavoidable absence of Mr. Edison and President Johnson, of the Light Company. It was but natural that a sense of exultation at the prospect of speedy results in the fight for the supremacy (which, if the patent laws of the United States mean any thing, are now near at hand) should be evident in all the utterances of the discussions. The cloud of uncertainty which long litigation always brings seemed to be lifted, and a tone of assurance and expectancy was one of the marked features of the session. A paper was read by J. H. Vail, general superintendent of the Edison Electric Light Company, on electric railways and their relations to Edison central stations, illustrating by statistics the advantages to be derived from their operation by Edison illuminating companies. A detailed statement was made by J. H. McClement, comptroller of the parent company, on the progress of the patent litigation. This was supplemented in the evening by a stereopticon entertainment arranged by W. J. Jenks, director of the Standardizing Bureau, showing in a series of slides the history of Mr. Edison's work. An interesting discussion of the results of the use of the Edison chemical meter brought out a paper of great practical interest by E. A. Kennelly of the Edison laboratory, under whose direct supervision experiments have been conducted the past year. The meter has been cheapened both in first cost and expense of maintenance, and samples of new types are now being made for the Paris Exposition. The possible errors, never large under reasonable management, have practically disappeared. A paper on the "Commercial Mean of the Incandescent Lamp," by Mr. Edison, was read by Mr. Upton of the Edison Lamp Company. This set forth in amplified form the practical results of the operation of the laws regarding lamp efficiency brought out some time ago by John W. Howell. It also detailed some interesting facts as to lamp breakage in central stations. The discussions developed the fact that one result of Mr. Edison's experimental work has been to secure fifty per cent more light from the same energy expended, while fully maintaining the guaranteed life of lamps, as a matter of actual record. The other papers were on "Medical Applications of Current from Central Stations," by J. W. Parcell, jun., of the Sprague Electric Railway and Motor Company; "The Steam-Engine," by Professor William D. Marks of Philadelphia; "Inspections," by W. J. Jenks. The executive committee reported in favor of holding the next meeting at Niagara Falls.

NOTES AND NEWS.

It is announced that Great Britain, France, Germany, Spain, Italy, Denmark, the Netherlands, Norway and Sweden, Brazil, Uruguay, Chili, Japan, and the Sandwich Islands have signified their intention of sending representatives to the International Conference which is shortly to be held to consider some means of signalling at sea that will render collisions less liable to occur than under the present system. The proposed conference is the result of a letter addressed to the different maritime powers of the world by the President of the United States, asking their co-operation in this matter. The date and place for holding the meeting yet remain to be fixed.

— Russia's boldness in pushing on her railway system across the Turcoman region to Central Asia has received its due reward. Already the line is declared to be paying its working expenses; and Gen. Annenkoff, the designer, has been encouraged thereby to ask permission of the Emperor to extend the line still farther to Tashkent. In all probability, the request, according to *Engineering*, will be acceded to, because Tashkent, besides being the administrative centre of the province of Turkestan, is a town with a population of 100,000 people, and the extension of the Samarcand section thither would not only tie an important political and trading centre to the Russian railway system, but also link the Syr Daria River and the Aral communications with those of the Caspian. The Aral fleet, as originally established, used to ply on the Syr Daria River, along the banks of which the Russians marched, and founded a series of forts and colonies, in their advance upon Tashkent and Samarcand. The great drawback the steamers had always to contend with was the absence of any fuel except a kind of brierwood known as saxaul. If the Samarcand line were extended to Tashkent, it would cross the navigable head of the river on its way, and be able to provide the steamers with liquid fuel from the Caspian, similar to the supply the railway was able to accord to those on the Oxus when it penetrated to that river a year ago. North of Tashkent stretches a series of steppes, adjoining those of Siberia, which are being gradually settled by colonists from Russia. This region, which is well adapted for agricultural and pastoral pursuits, would benefit considerably by the extension of the railway to Tashkent; so that Gen. Annenkoff has many cogent reasons, besides those of a military character, to adduce in support of his project. It is curious to contrast this activity of the Russians with the lethargy of English authorities in regard to the Indian frontier communications. If the completion of the Quetta line to Candahar would not pay the whole working expenses of the railway from the Indus, it would at least more than pay that on the extension, while adding immeasurably to the security of the Indian Empire. In Burmah again, where Gen. Sir Frederick Roberts, four years ago, urged upon the government the rapid construction of railways as a means of pacifying the country, no important lines, except the slow-paced Tounghoo-Mandalay line, have been taken in hand, and money is being wasted in punitive expeditions against dacoits and tribesmen, which would have been far more advantageously spent on railway-works.

— For paving streets, India-rubber threatens to enter into competition with asphalt. This new pavement, according to the *Engineering and Building Record*, is the invention of Herr Busse of Linden, Prussia, who has introduced it in Hanover. He used it first in the summer of 1887 for paving the Goethe Bridge, which has a surface of about 1,000 square metres, or 10,764 square feet. The new pavement, it is stated, proved so satisfactory that 1,500 square metres (16,146 square feet) of ordinary carriage-way in the city were paved with it last summer. The Berlin corporation, being favorably impressed with the new pavement, has had a large area paved with India-rubber as an experiment, and the magistracy of Hamburg is likewise trying the pavement. It is asserted that the new pavement combines the elasticity of India-rubber with the resistance of granite. It is said to be perfectly noiseless, and unaffected either by heat or cold. It is not so slippery as asphalt, and is more durable than the latter. As a covering for bridges, it ought to prove excellent, as it reduces vibration; but a question may be asked as to its cost. The expense must be heavier than that of any known pavement.

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IN A RECENT NUMBER of *Science* we called attention to the danger to which travellers on ocean steamers are subjected when their stateroom companions happen to be consumptives. That this danger is not an imaginary one seems to be demonstrated by an incident which recently occurred in France. A French physician, Dr. Gautier by name, has been investigating the question whether tuberculosis may be communicated by means of its bacilli. That this is possible for lower animals has been thoroughly proved. Dr. Gautier has himself fallen a victim to the disease, having become infected from the pulverized tuberculous sputum with which he was experimenting, thus showing that the disease is equally communicable to man.

WE ARE NOT APT to look to South America for evidence of the greatest progress in science or art, and yet it is said that the sewerage system which is now being constructed in Buenos Ayres is the most perfect in the world. Measures have been taken which will result in putting every house in the city in perfect sanitary condition within three years. Sanitarians will watch the result of this stupendous undertaking with great interest, and will be able to deduce from it many valuable practical lessons.

TO-DAY'S NEED AT JOHNS HOPKINS UNIVERSITY.¹

YOU have doubtless observed, that though this is our annual celebration, when memory and hope are the keynotes of a festival, yet there is an undertone of anxiety, an unwonted seriousness in our demeanor and in our words. You know as well as I the cause; but you do not know as well as I the resolution which determines us to turn a temporary loss into a permanent gain. The best financiers can do no better. It is true that we have lost for a time our income from the Baltimore and Ohio Railroad, the securities to which the sagacious founder of the university intrusted his endowment, with so much confidence that he recommended his trustees not to dispose of the stock, but to keep it as an investment. He was doubtless influenced by the fact that this security was free from the taxation which would fasten itself upon another investment.

We believe that this suspension of dividends upon the part of the Baltimore and Ohio Railroad is but temporary, and that the stock is now, and always will be, property of great value. But we have possessions of even greater worth. The Johns Hopkins University owns nearly three hundred acres of land within the present limits of the city, which will soon be laid out in streets and avenues. Fifteen or sixteen miles of street frontage can then be sold or rented. "The past at least is secure;" but to this familiar utterance we can safely add, "the future is as secure as the past." Our cause for anxiety is the present. How shall we make the transit between the prosperity of the past ten years and the prosperity that is to follow? How shall we meet the emergency of the next five years?

There are but three ways, — contraction, borrowing, begging. Contraction brings disaster, borrowing brings a day of reckoning, begging is not pleasant.

It is not agreeable to the managers of a great institution to ask the public to come to their support. It is natural that they hesitate before taking any such step. It is particularly difficult for those who have devoted their lives to the advancement of knowledge and the education of youth, who have renounced aspirations for wealth, who seek for no other preferment than the modest distinctions of an academic life, who are willing that their families should grow up without expectations beyond the inheritance of an honorable name, and who only ask, that, with proper books and apparatus, they may be allowed to continue in the service to which they have consecrated their lives — I say it is especially hard for such persons to ask the public to come to their relief. So it seems to fall upon me, who am not a professor on the one hand, nor a trustee on the other, to say the few frank words which others hesitate to utter.

The situation is this. A prudent management of our affairs during the last few years has enabled the trustees to pay all their current expenses, to build three great laboratories, to collect a large library and a great amount of apparatus, and to buy a great deal of real estate for the buildings that are wanted, and at the same time to lay by a considerable amount of accumulated income. This store they are now spending. It is not, like the widow's cruse, inexhaustible; but if the sum of \$100,000 can be added to it, and if our receipts from tuition remain undiminished, the university will go forward during the next three years without contraction, without borrowing, and without begging. I am happy to say, that although the trustees have not felt willing to make an appeal to the public, and although no authorized statements on this subject have been published, a number of the citizens of Baltimore have, of their own accord, expressed the desire to raise this amount, and have pledged themselves for generous sums. It would be difficult for me to express the encouragement I have received, as one and another of these helpful friends have intimated their readiness to contribute liberally toward the desired amount. More than half of the proposed fund has already been definitely pledged. One subscription has come from New York, another from Liverpool; but almost all, as we might expect, have come from those who are most intimately acquainted with the working of the university, — our own neighbors and friends, who know the difficulties under

¹ Remarks of Daniel C. Gilman, president of the Johns Hopkins University, on the thirteenth commemoration day, Feb. 22, 1889.

which we labor, the methods which we follow, and the hopes by which we are inspired.

A most gratifying sign is the eagerness which young men, whose accumulations as yet are but small, have shown in their desire to come to our assistance. Many such persons are among our own former pupils; others are but lookers-on in Baltimore. I am sure that if it were worth while, the amount still lacking could readily be made up by the contributions of those whose love to their young alma mater is as loyal as that of the sons of Harvard, Yale, and Princeton. Here, for example, is the letter of a Baltimore boy, enclosing a modest check for forty dollars, which, although it is marked "private," I venture to read in part:—

"I can never cease to retain the warmest feelings for my alma mater, for I am not only doubly an alumnus of the university, but am also, by birth, a Baltimorean, and of an old Maryland family, and as such am proud that the greatest American university is to be found in my city and State. I beg, therefore, that you will accept the enclosed check. . . . If you think it desirable, I should be happy to have you call on me for a yearly payment of one hundred dollars as long as the university fails to receive an income adequate to meet its expenses. No one is more keenly sensible than I of the extreme paltriness of this sum. I regret that it is all that I can do; but I can say that if others, equally interested, would contribute in proportion to their income, as I have done with mine, the university would never have to fear pecuniary embarrassment."

But it will not be necessary to ask such aid. The mature and prosperous citizens, who know the conditions of municipal advancement, who know the value of a good name, who know that not money alone has lasting value, but that which money brings in education and refinement, the mature and prosperous citizens of Baltimore, who have received two great gifts from men of New England birth, and two great gifts from an Anne Arundel boy, cannot afford to let an institution that has made the fair name of this city familiar to the scholars of every race and every clime, relinquish in a day of temporary embarrassment the prestige which has been acquired by thirteen years of labor.

GROWTH OF THE AMERICAN ECONOMIC ASSOCIATION.

THE American Economic Association has issued a report, by E. W. Bemis, Ph.D., of its branch associations. Eighteen months ago, Mr. Bemis, as secretary of the first economic branch of this association, reported its success, and urged the organization of similar associations elsewhere. That suggestion has been adopted, and now there are six branches, with over one hundred and fifty members, in the following places: Springfield, Mass.; Orange, N. J.; Washington, D.C.; Buffalo, N.Y.; Galesburg, Ill.; Canton, O.

In view of the great possibilities of growth and influence of these economic centres throughout the country, it becomes important to decide upon a plan of organization. These branches are of three types,—that of Springfield, of Galesburg, and that of Buffalo as at present organized.

The Connecticut Valley Economic Association, organized at Springfield in January, 1886, and now numbering about fifty members, has prospered from the first. This association, like others, is allowed to retain one-half of the three dollars dues for local expenses; and this small sum, thanks to the generous help of the able speakers who have come to Springfield, has thus far covered all expenses. A good room, lighted and heated, is given without charge in the High School building. Similar cheap but suitable places for meeting have been secured in public buildings and private offices by the other branches. Meetings have been held once a month save in summer, and many original contributions to economic theory and investigation have been given which have since seen the light in our economic quarterlies and monographs. A large proportion of these has been given by professors of New England and New York colleges, and by others not connected with the local branch, though six or eight members have also made valuable addresses.

Successful as this experiment has been in many ways, three weak points have been developed: first, a difficulty in securing able lecturers whose regular work would admit of a visit to Spring-

field,—a difficulty less felt in this branch than would be true almost anywhere else, owing to the peculiarly favorable location of Springfield within thirty miles of Amherst and Smith Colleges, and one hundred and thirty miles of Harvard, Yale, Brown, and Columbia, yet a real source of anxiety often to the officers, and one likely to grow from the exhaustion of the field of economic teachers and writers of note within reasonable distance, for it is too much to ask the same person from outside the branch to give his strength often in this missionary work; the second weakness in the Springfield plan lies in the almost inevitable lack of continuity in economic study as long as a different subject is taken up at each meeting; the third difficulty has been the failure of a monthly address, followed by a general discussion, to draw out the resources and greatly stimulate systematic reading in the science of economics on the part of the main body of the members.

That these are sure to prove serious obstacles to success has been proved in Buffalo, where a branch similarly organized a year ago, but cut off by distance from well-known economists, languished, till restored to vigorous life last month in the manner soon to be described.

The branch at Galesburg, Ill., has avoided the difficulties thus far described, but has fallen into one or two others. There the number in the association is limited to twenty-five, elected by the existing members; and no one is allowed to join who does not assume the responsibility of preparing in turn, about once a year, a paper for one of the fortnightly meetings. Further, in order to secure continuity of study, half a dozen or more meetings in succession take up various phases of a single subject, as money, monopolies, the labor question, taxation, etc. By this form of organization much mental development and great interest have been secured; but the limitation of membership and the conditions of admission have kept away a number who would like to join.

The attempt to combine the Springfield and the Galesburg plans has just been made with prospect of success in Buffalo, N.Y., and Canton, O. At Buffalo a reading-circle within the local branch has been formed of all the local members ready to submit to the conditions of admission, which are, attendance, if possible, at every fortnightly meeting, and assumption of the work involved in preparation for the meetings, at which two lines of study are taken up. The first forty-five minutes of each meeting is to be devoted to systematic study of some portion of the general subject assigned for five to eight successive nights: thus, Professor Ely's "Taxation in American States and Cities" is now being studied. Each of the twenty members of the reading-circle reads in advance as much as possible of the chapters assigned for the meeting, and joins in discussion, after two or more members, appointed for the purpose a month previous, and selected in turn from all the members, have given a digest and criticism of the chapters under consideration. The second forty-five minutes is taken up with a review of recent economic articles in twenty-six different American and European magazines, consular reports, and other official publications. One or two of these magazines are chosen for review throughout the year by each member. No constitution for this inner circle has been adopted, but every one who joins does so with a clear understanding of the obligations thereby assumed. The chair is filled each evening by nomination, and the secretary of the general association is secretary of the inner circle. The selection of topics and speakers is in the hands of a topic committee.

This form of organization is too recent to give much ground for forecast; but if the character, ability, and enthusiasm of the members as witnessed by Mr. Bemis the past month be any criterion, excellent results are probable. The Springfield idea of securing for the general membership addresses from outside is adhered to, but no attempt will be made to secure more than four or five such a year.

At Canton, O., about twenty persons, both men and women, as in all the branches, have just formed a branch similar to that as now re-organized at Buffalo, save that in Canton the inner reading-circle, or the active members so called, elect all the officers of the branch from their own number, and admit the associate members to the meetings and discussions, as is not done in Buffalo save on direct invitation of some active member. In Canton the method of work and the conditions of active membership are like those in

Buffalo. In both places local researches in taxation and other economic subjects are also contemplated. The secretary of the Canton branch reports that Professor Ely's "Problems of To-Day" is being studied, and that "the members are enthusiastic."

The branches at Orange, N.J., and Washington, seem to have patterned largely after the Springfield plan.

These suggestions may furnish some help in the solution of the problem of how to extend the work and influence of the association, and form centres of economic study in many parts of our country.

THE WEATHER SERVICE.

THE popular dissatisfaction with the weather predictions as now furnished by the Signal Office has become so great, that a thorough discussion of what is best to be done to improve the service is certainly desirable. Such a discussion has been taking place in the columns of the *Boston Post*, and from that paper we here quote from a recent letter of Mr. H. H. Clayton of the Blue Hill Meteorological Observatory, Readville, Mass. In an editorial note the *Post* seems inclined to doubt the wisdom, if not the truth, of the sweeping assertion of the inefficiency of a large part of the Signal Corps made by Gen. Greely in his recent report to Congress, and it was this which called forth Mr. Clayton's letter in which he takes the following ground.

"Gen. Greely may possibly not be right in his specifications as to exactly what persons are inefficient, but any one who has studied the history of our weather service in comparison with that of foreign countries can scarcely doubt but there is great inefficiency somewhere in our service; and it seems right to allow Gen. Greely every assistance possible to improve the service, until there is proof that his efforts are in the wrong direction. The financial support and the facilities afforded our signal service are the best in the world, and it has been a continuous surprise to the writer that its efficiency has not been greater. The following figures show in round numbers the amount of money appropriated by various governments in Europe and America for the support of their weather services: United States, \$900,000; Great Britain, \$80,000; Germany, \$56,000; Russia, \$65,000; Austria, \$10,000; Switzerland, \$6,000; France, \$40,000. This estimate for France does not include the cost of observations made at a few astronomical observatories and mountain stations, which may perhaps increase the total amount expended by France to \$60,000. It is thus seen that the amount of money appropriated for its weather service by the United States is ten times greater than that of any country in the world, and is greater than the amount appropriated by all of the governments of Europe combined, including Italy and others not mentioned above.

"In Europe a large part of the observers are voluntary observers, or they are men who are engaged in other pursuits, and for a small compensation take meteorological observations, and telegraph them to the central stations. For this reason it has been necessary to adapt the observations somewhat to the convenience of the observers, and it has been impossible to obtain all over Europe a system of simultaneous observations such as are obtained in the United States. The principal set of observations in the different European countries is taken all the way from 7 A.M. to 9 A.M.; and on account of the difficulty of arranging codes, and transmitting telegrams from one country to another speaking different languages and having different interests, it is almost noon before the morning observations are in an available form in the different countries for use in making weather predictions, while in the United States it is but little more than an hour after the observations are taken before they are available for use at the central office. Again, owing to their small appropriations, none of the European countries have been able to obtain extensive reports more than once a day from surrounding countries, and thus form a set of relatively complete weather maps, such as was previously done three times a day in the United States, and is now done twice a day. The full weather map made by the European weather services is from the morning reports taken between 7 and 9 A.M., though most of the services make supplementary maps from less complete reports received in the afternoon and evening.

"So far, it is seen, then, that our weather service is better equipped, and with far better facilities for effective work, than any service in the world; but what are the results? In 1881 the per cent of verification of their weather predictions estimated by the French meteorological office was 82. Since then it has steadily risen, until, in 1888, a verification of 90 per cent was claimed. In the same manner the per cent of success estimated by the London office for Great Britain has risen from 78 per cent in 1882, to 83 per cent in 1887. In Germany the per cent has risen from about 80 per cent ten or twelve years ago, to 88 per cent in 1887. According to the official verifications of our signal service, the per cent of successful weather predictions rose from about 82 per cent in 1875, to 89 in 1883, and then decreased irregularly to 74 per cent in 1887, or 81 per cent when corrected for the greater interval covered by the predictions. These signal-service verifications for different years are not strictly comparable, because they were verified according to varying rules and with different degrees of care; but the signal service uses them so, and the figures at least agree with the general impression that there has been no increase in the accuracy of the signal-service predictions during the last fifteen years. Neither are the per cents of verification for one country comparable with another, since many of them were verified by different rules; but the results are comparable among themselves, and the steady increase of accuracy claimed for the European weather predictions is no doubt a fact. The able papers and investigations proceeding from the members of the European bureaux seem sufficient evidence that great thought is being given to the improvement of meteorology, and the advance of meteorological knowledge is undoubted.

"The great difficulty with our bureau seems to have been that Congress made it a military rather than a scientific organization. Several years ago a committee appointed to investigate the bureau recommended that it be transferred to a civilian organization, either gradually or suddenly. The National Academy of Science, when consulted on the subject, recommended the same thing; but for some reason unknown to the writer, Congress has neglected or refused to make such a transfer, and last year struck out a clause to that effect in the agricultural bill. There is scarcely any doubt, that, with some scientific investigation, certain of those storms might have been predicted which in recent years have struck our coast unheralded by the signal service, and left wreck and ruin behind,—notably the storm of Jan. 9, 1886, for which no signals were ordered, and in which it is estimated that about 125 vessels were wrecked on the New England coast. Were the weather service of our country in the hands of well-selected scientific men, it would undoubtedly become, as it ought to become with such splendid facilities as it now has, one of the finest meteorological bureaux in the world. If, however, this cannot be, it is hoped that every facility will be furnished Gen. Greely to make it an effective military organization. Gen. Greely's recent books and excellent 'Report of the Lady Franklin Bay Expedition to the Arctic Regions' indicate a deep interest in and a knowledge of the needs of meteorology, and he is no doubt sincere in his efforts to increase the efficiency of the Signal Corps.

"Besides the re-organization of the bureau, an immense advance might be made by organizing local predicting bureaux, where the predicting officers could make a closer study of the conditions surrounding them, and gain more time for prediction, instead of, as now, being compelled rapidly to make predictions for almost the entire length and breadth of our land, which is many times larger than any country of Europe, except Russia. The favor with which the Blue Hill predictions, as well as those of others in this and other parts of the United States, have been received, seems proof that local weather bureaux would be at once appreciated by the public."

MENTAL SCIENCE.

The Genesis of Error.¹

PROFESSOR S. EXNER of Vienna contributed to the Congress of German Naturalists and Physicians a very suggestive essay upon the principles underlying the origin of illusion in man and the ani-

¹ From the *Revue Scientifique*, Jan. 12, 1889.

mal world. The physicist, he observes, before deducing any result, takes into account the errors of his instruments. The scientist is always working with one certain instrument, the human mind. The errors of this ever-present factor in all work form a most important field of study.

In the study of instincts, such as those that direct birds in the building of their nests, insects in the formation of their communities, we often admire the wonderful resemblance of these complex acts to the results of reason. And yet we recognize an important distinction between them: their sphere is limited, their power of adaptation to new conditions is small. It is a remarkable mechanism, but has application to a limited number of movements. A bird shows remarkable skill in weaving the threads with which it builds its nest, fastening it to the limb of a tree, and adapting it to the shape of the twig. But tie the foot of a bird in a cage, and it cannot make use of its skill in weaving to untie the fastening, but struggles and flutters until it kills itself or is accidentally freed. Teleologically speaking, certain adjustments are ingrained in its nervous system; but these adjustments are special, not general. The more perfect the instinct, the more stable and invariable is it; the less rigidly the adjustments are ingrained, the more does the act resemble what we term "reason." Diversity and adaptability are the marks of rational development. The weakness of animal intelligence is always in the lack of ability to break away from routine associations; to proceed from two facts to a third. A dog will defend himself if you tease him, but he will not bite. He knows how to use his teeth well enough with his fellows, but towards man he has acquired an attitude of deference.

Animal instincts result from the environment, and must be judged in the environment. When looked at from a human standpoint, these actions seem foolish and irrelevant. We, too, have our rigid instincts, our reflex actions. The closure of the eyelids when an object threatens the eye is a useful protective mechanism; but when we are to undergo an operation, it may be harmful. None the less all the strength of the will is incompetent to keep the eye open. It acts according to its acquired habits. It is true that we are conscious of our error, which animals are probably not; but this is not an essential point. It is proposed to show that the typical kinds of error arise, as do these misapplications of instincts, from the unwarranted application of a general rule to a particular case.

The majority of sense-deceptions support this view. Irritation of any part of the retina arouses a sensation localized in space where an object causing such an irritation would ordinarily be found. In some cases we are freed from illusion by the remembrance of former experiences. Savages are apt to mistake an image in a mirror for a real object behind it: repeated experience allows us to see the image as an image in the plane of the mirror.

Here it is easy to distinguish between the sensory and the memory factors, but in some cases this may be difficult. If you draw a line on a sheet of paper, and cover it up with a second sheet so as just to conceal the end of the line, and show it to some one ignorant of the arrangement, he will be greatly surprised not to find the entire line longer than it is when you remove the second sheet. He does this because it is an uncommon experience to have so little of a line covered up. He cannot help forming a prejudgment on the basis of what is most probable. Is this an error of sensation, or of memory?

There are a host of similar deceptions. One need only refer to the tricks of the conjurer. He takes care to appeal to something true as a rule, but false in this particular case. Again: he directs his gaze towards his right hand, infallibly carrying the eyes of the observers to the same spot, while he is performing the trick with the unobserved left hand. Ordinarily we direct our attention to the point of the field of vision in which an action is going on, and we erroneously follow this rule when we should not. We as mechanically obey the general rule as we close our eyelids when an object threatens us.

The illusion consists in the observation of the general to the exclusion of the special. A high intelligence consists in the command of a wealth of associations, and thus a power of distinguishing between the two. A typical instance is that of the host of persons who religiously record the numbers drawn at the lottery, reasoning,

that, inasmuch as all numbers have an equal chance of being drawn, numbers not drawn now must have a greater chance of being drawn later on. In all games of chance one hears the same argument. The luck must change: good fortune must be followed by bad, and *vice versa*. This common error, again, consists in overlooking the particular case; for while, in many cases, such reasoning would be entirely correct, in the case of the lottery and of games of chance it does not hold, because the numbers are all replaced, the cards newly dealt after each issue, thus making the chances of every lucky event just the same as before. It is a confusion of the case in which the ball is returned to the urn with the more frequent cases in which it cannot be returned. Of the same character is the belief in the luckiness or unluckiness of certain players; in the argument, that, because a person has happened to receive more than a normal share of lucky turns, he has a right to expect the continuance of such luck; or, again, the fancied relations between the weather and terrestrial events, etc.: in short, in many kinds of superstition.

More refined examples of the same kind of error can be found in the fields of art and science. When an architect supports a balcony upon two slender iron pillars, it does not appear pretty, because of the disproportion between the supports and the object supported. The origin of this judgment is to be traced to the fact that we have comparatively little experience with the strength of iron, and much experience with the weight of stone. In general, the impression of solidity carries with it the sentiment of beauty; while the use of iron, however convincing the calculations of the architect, does not carry with it this impression. In various forms of art we see the same association between the form and the material used. Our traditions and the experiences of the race thus play a rôle in our sentiments, and are a factor in the genesis of error. The Greeks built temples of marble in a style derived from times when wood was the building-material. Returning to science, we may examine the famous argument of Zeno for illustration of our main thesis. Achilles cannot overtake the tortoise if the latter is at all ahead of him, because, while Achilles makes up the distance, the turtle has advanced beyond it; and so on. We get the impression of infinite space by the infinite aggregation of finite spaces, because ordinarily such a sum would be infinite; but here the spaces tend to the infinitely small, and so their sum to a finite quantity. In spite of the ages of discussion spent over this problem, it still remains a real source of error; and from this puzzle of Zeno, down to the blind action of a humble animal, one can trace the genesis of error as a faulty application of a general law to a special case; as the instinctive action of an ingrained nervous adjustment to an environment different from the normal.

ABNORMAL SENSE-ASSOCIATIONS. — Increased attention has recently been given to a class of sensory associations of rare occurrence but extremely interesting. When a certain part of the body is hurt, some persons simultaneously feel a pain in a distant and disconnected part of the body: to these the name of "synalgia" has been applied. They are idiosyncrasies, and are of various kinds. So, too, there are "synæsthesias," or cases of an irritation in one place causing a sensation in another. Dr. Fromentel brings these into line with the common experience of sneezing in response to a glaring light stimulation. He does not regard this as reflex, but thinks it psychic in character, and due to the irradiation of a disturbance in the cortex of the brain. The explanation ascribing the connection to an anastomosis between various nerves is also rejected. The peculiar case of hearing colored sounds would also be susceptible to the same explanation. They would be more or less present in all persons, but would only be striking in peculiarly nervous individuals.

BOOK-REVIEWS.

Physical Realism. By THOMAS CASE. New York, Longmans, Green, & Co. 8°.

THIS work contains a criticism of philosophical idealism, or subjectivism, together with the presentation of a new theory which the author offers in its stead. According to the view of Berkeley and his followers, the external world of material things has no real existence, what we call a body being in fact nothing but a cluster of

ideas and sensations in our minds. This theory Mr. Case holds to be contradicted by physical science, which reveals to us certain objects, such as the waves of light, for instance, which are not and never can be objects of sense, but which are nevertheless known to exist. He takes up the works of the leading idealists, and makes an elaborate criticism of their views and of the arguments by which they sought to support them; and this part of his work contains much interesting and useful matter. He rightly regards Descartes as the real founder of idealism, because he assumed that the immediate objects of knowledge are ideas, although he endeavored to reach a knowledge of the external world by inference. This fundamental assumption of Descartes, which has been repeated by every idealist since, is justly treated by Mr. Case as a begging of the whole question; and the passages in which he criticises it are the best in the book. He does not confine his strictures to this one point, however, but deals also with Hume's theory of belief and association, Kant's doctrine of necessary truths, and other topics more or less nearly related to the idealistic view. Some of his remarks, especially on the subjects of induction and necessary truth, seem to us quite as doubtful as those he criticises; but the whole of this portion of his work is well worthy of attention.

Mr. Case has not confined himself, however, to criticism, but has presented a theory of his own in place of the one he criticises; and with regard to this we are obliged to dissent from him. Rejecting idealism as he does, he equally rejects the natural realism of the Scottish school, and maintains that the object of sense-perception is neither an idea nor a body outside of us, but an affection of our nervous system. "The sensible object," he says, "is the nervous system itself sensibly affected. The hot felt is the tactile nerves heated, the white seen is the optic nerves so colored" (p. 24). And again: "I perceive my nervous system, not so far as it is nervous structure moving, but so far as it is sensibly affected in different parts, the optic nerve so far as it is visibly white, the gustatory nerve so far as it is sweet to taste, and so on" (p. 151). Now, we think most people will deny this assertion outright. This reviewer, certainly, is not conscious of perceiving his own nerves sensibly affected, and it was only by studying anatomy that he learned that he had nerves. Besides, what does Mr. Case mean by calling the nervous system, as he repeatedly does, an "internal" object? "Internal," with reference to this question, means "in the mind;" and "external," "out of the mind;" and therefore my own nervous system is just as truly an external object as is the farthest star that I can see. For these reasons we cannot think that Mr. Case has solved the problem of perception.

The Development of the Intellect. By W. PREYER. Tr. by H. W. Brown. New York, Appleton. 12°.

SOME weeks ago we referred, on its appearance, to the first portion of Mr. Brown's translation of Preyer's great work, "*Die Seele des Kindes*," and expressed our gratification that it satisfactorily presented to the English reader the results of the Jena physiologist's researches in the field of child-psychology.

The second part, which is before us, is equally well done, and it fully sustains the reputation of the International Education Series, of which it forms Volume IX. A conspectus of Professor Preyer's results, prepared by the translator, greatly increases the value of the book to the average teacher and to the ordinary reader.

The author sees in the power of language and its development the safest and best guide to the tracing of intellectual development, and he traces the growth of this power with great caution and fullness of knowledge. We cannot in this brief space attempt to condense the argument of the book: we must be satisfied to repeat substantially what we said of "*The Senses and the Will*:" it is a safe companion for any teacher in her study of the unfolding of a child's mental power, and a stimulus to further research and investigation.

Political History since 1815. By CHARLES H. LEVERMORE and DAVIS R. DEWEY. Boston, W. J. Schofield. 8°. \$1.25.

THIS book is an abstract of lectures delivered in the Massachusetts Institute of Technology: hence it is hardly adapted for reading, but it will serve admirably as a guide to historical students, and also to refresh the memory of those who have studied. It

covers the political history of the whole world since the fall of Napoleon, with the exception of the United States, the history of our own country evidently being a separate study in the institute. The selection and arrangement of topics in the book seem excellent; and we are particularly pleased with the small attention given to military affairs, which in some books called histories overshadow every thing else. The opening lecture treats of the various races, governments, and religions of the world; and the remainder of the work presents the recent history of the various nations separately, beginning with England and her empire, and ending with the African continent. The dates of important events are given, and some statistical matter is introduced. A bibliography of the subject is given, and special authorities are cited on all important points. The book is well and carefully printed, and must, we should think, be very useful to students of the field it covers.

Shall We Teach Geology? By ALEXANDER WINCHELL. Chicago, S. C. Griggs & Co. 12°. \$1.

IN this work Professor Winchell sets forth the claims of his favorite science to a more prominent place than it now holds in general education. He first inquires what education is, and comes to the conclusion that it includes both the training of the faculties and the acquisition of useful knowledge. He has an excellent chapter on the faculties themselves; and, while admitting that some of them are better developed by literature or mathematics, he insists that no study will develop them as a whole better than geology. Like most physical scientists, he is severe on the study of languages, especially of Greek and Latin; and, so far as the mere languages themselves are concerned, we incline to agree with him. But language is the medium of literature; and Professor Winchell seems to show an inadequate appreciation of literature, and of the moral and intellectual culture that it gives. But the principal defect of his work is its ignoring of the mental and social sciences. He seems hardly aware of their existence; for he mentions none of them but history, and mentions history only to slight it, declaring that it trains no faculty but verbal memory. His disparagement of history is peculiarly unfortunate, for history is to the evolution of man what geology is to the evolution of the earth and its flora and fauna; and it is surely as important for us to know how man has come to be what he is as to know how the earth's crust has come to be what it is. To this reviewer it seems that the most important study at the present day is that of man, his nature, his duties, and his history; and if this is so, it is hardly possible to give geology so much attention as Professor Winchell desires: for he is not satisfied with a year's study or so, but would have the subject taken up in the primary schools, and pursued every year as long as the student attends school. When we consider that geology is only one science out of fifteen or twenty, and when we further consider the importance of literature and the need of learning foreign languages early in life, it is evident that we cannot give so much time to geology alone. Nevertheless, we are glad to see the claims of the science so well presented, and we hope Professor Winchell's book will be read by educators everywhere.

A Historical Geography of the British Colonies. By C. P. LUCAS. Vol. I. Oxford, Clarendon Pr. 12°. \$1.25.

WE noticed some time ago the little volume introductory to this work, and we are now glad to receive the first volume of the work itself. It contains a little less than two hundred pages, and treats of the European dependencies of Great Britain, and the minor dependencies in Asia and the Indian Ocean. In preparing the work, Mr. Lucas has had the assistance of various persons connected with the governments of the colonies in question, and the portions relating to Malta and Cyprus have been mainly written by one of his associates in the Colonial Office. The work has been prepared with care, and contains a large amount of information in comparatively small space. Each dependency is treated separately, while at the same time their relations to each other and to the home government, and their importance to the empire, are duly pointed out. The history of each is briefly recorded, and sometimes, as in the case of Malta and Cyprus, it makes interesting reading. Then the main geographical features are described, and an account is given

of the people and the mode of government. Most of the colonies, or dependencies, dealt with in this volume are valuable chiefly as naval and commercial stations, this being particularly the case with Gibraltar, Malta, Aden, Singapore, and Hong Kong; but others, such as Cyprus, Ceylon, and Mauritius, have inherent resources of their own. The work shows the immense variety of races, religions, and material interests with which the British Colonial Office has to deal; and this notwithstanding none of the larger dependencies are touched upon. Germans in Heligoland; Spaniards, Italians, Greeks, and Turks in the Mediterranean; Arabs, Negroes, Indians, Malays, and Chinese in the Eastern seas,—all pass in review before us; while the three great religions of the world,—Christianity, Mohammedanism, and Buddhism,—besides minor faiths, are represented. If the work is completed on the plan of this volume, it will be useful not only to geographers, historians, and statesmen, but to all intelligent persons who wish to be informed about the world's affairs.

AMONG THE PUBLISHERS.

ROBERT CLARKE & CO., Cincinnati, O., announce the fifth edition of "Benner's Prophecies," with forecasts for 1889, 1890, 1891. These prophecies are of future ups and downs in prices, and what years to make money on pig-iron, hogs, corn, and provisions, by Samuel Benner, an Ohio farmer.

—The following are from the contents of the *Popular Science Monthly* for March: "New Chapters in the Warfare of Science," by Andrew D. White, LL.D.; "The Chemistry of To-Day," by Professor Ira Remsen; "Glass-Making," by Professor C. Hanford Henderson; "South Slavic Moon-Myths," by Dr. Friedrich S. Krauss; "Competition and the Trusts," by George Iles; "Law as a Disturber of Social Order," by Benjamin Reece; "Among the Fiji Islands," by Coutts Trotter; "The Foundation-Stones of the Earth," by Professor T. G. Bonney; "Natural Science in Elementary Schools," by J. M. Arms; "The Aryans in Science and History," by Horatio Hale; "The Americanists in Congress;" "Sketch of Pierre Belon" (with portrait); also the regular correspondence and editorial departments, literary notices, popular miscellany, and notes.

—The *American Journal of Archaeology*, Vol. IV. No. 4 (Boston, Ginn & Co.) contains "Inedited Terra-cottas from Myrina, in the Museum at Constantinople" (with 2 Dujardin heliotype plates), by Salomon Reinach; "Discoveries in the Attic Deme of Ikaria," by Carl D. Buck, and "A New Sikyonian Inscription," by Mortimer L. Earle, both members of the American School of Classical Studies at Athens; "Early Bronzes discovered on Mount Ida in Krete" (with 5 plates and 4 figures), by A. L. Frothingham, jun., professor of archæology at Princeton; "Remains of an Ancient Greek Building discovered in Malta" (with ground-plan), by A. A. Caruana, director of education in Malta; notes on the excavation of a Christian palace at Rome, and the existence of America known early in the Christian era; reviews and notices of books on archæology—general, Oriental, classical, Christian, and prehistoric—and on the Renaissance; archæological news from Asia Minor, Austria-Hungary, Central America, Colombia, Denmark, Egypt, England, France, Germany, Greece, Hindustan, Italy, Krete, Kypros, Palestine, Phœnicia, Russia, Sicily, Spain, Syria, Tunisia, Turkey, United States, and Wales; and summaries of archæological periodicals.

—William H. Burnham, Ph.D., late fellow of Johns Hopkins University, will give in the March *Scribner* some valuable practical suggestions to busy men for economy in brain-work.

—The *Contemporary Review* for March (New York, Leonard Scott Publishing Company) will contain an important paper on the Panama Canal by the eminent traveller, Mr. Edward Whymper, illustrated by a large chart of the scene of operations, etc. An interesting and full *résumé* of the financial condition of the Canal Company appeared in the *Nineteenth Century* for February, 1888, which is particularly valuable, in view of the recent collapse of the enterprise.

—Probably the most interesting paper in the *Scottish Review* (New York, Leonard Scott Company) for the present quarter is a translation of Ivan Turgeneff's weird story of the "White Lady."

The spirit which forms the central figure in this extraordinary play of the imagination belongs to a class which appears more frequently in the popular beliefs of Russia than in those of other countries. It is, however, not unknown in Scotland. Sir Walter Scott's ballad of "Glenfinlas," for example, is based upon a legend of a young man killed by a being of this sort,—a catastrophe which Turgeneff has obviated or postponed by the use of a peculiar expedient.

—No less than eight editions have been called for of the *Contemporary Review* for February, containing the remarkable article on the Bismarck dynasty. This article is said to be circulating freely in Germany.

—"England and Germany in East Africa" forms the subject of the opening paper in the *Fortnightly* this month. Professor Dowden writes on "Hopes and Fears for Literature;" Mr. Swinburne continues his notice of Victor Hugo's poetry; Professor Tyndall furnishes another instalment of his articles on "English Light-house Management;" Dr. Ingram writes on "Two Centuries of Irish History;" and Mrs. Lynn Linton begins her series on "Characteristics of English Women." Among the other articles, the unsigned one on the "Trade of Author" will probably attract most attention.

—The February number of the *Modern Science Essayist* contains "Solar and Planetary Evolution," an essay by Garrett P. Serviss, together with criticisms on the essay by R. G. Eccles, M.D., Professor Van der Weyde, and L. G. James, M.D.

—The "Truth Seeker Annual" for 1889 contains a fine picture of the statue of Giordano Bruno, soon to be erected in Rome, and two illustrations showing the Lick Observatory and its great telescope.

—During the session of the Electric Light Convention at Chicago last week, the *Western Electrician* issued a daily edition, containing full reports of the proceedings.

—Col. T. W. Higginson's poems, which Longmans, Green, & Co. are about to publish in New York and London, are dedicated to J. R. Lowell, "schoolmate and fellow-townsmen." The volume is called "The Afternoon Landscape," for the morning of the poet's life is now past. The poems include the sonnet to "Duty" and the lighter stanzas on "A Jar of Rose-Leaves." Among the translations are Sappho's "Ode to Aphrodite," and a dozen sonnets from Petrarch and Camoens.

—"Micah Clarke: his Statement" is the title of an autobiographical tale of Monmouth's rebellion, which is soon to be published by Longmans, Green, & Co. It is rather a narrative of personal adventure than a romance, yet the author's art recalls both "Lorna Doone" and "Kidnapped." This is a tale of adventure, full of strong incident and vigorous character-drawing, with not a little incidental humor. Saxon is a younger brother of Dugald Dalgetty, and quite as delightful in his professional pride.

—The *Political Science Quarterly* for March opens with a striking article by H. L. Osgood, upon "Scientific Anarchism," reviewing the theories of Proudhon, and showing the aims of American anarchists. Professor Gustav Cohn of Göttingen, taking the progressive income taxes of Switzerland as his text, indicates the merits and the dangers of this democratic scheme of taxation. Mr. Arnold Forster (son of the late Irish secretary) presents forcibly the Unionist view of the Irish question. A conservative Frenchman, M. Gauvain, explains the causes of the present crisis in France, and the significance of "Boulangism." Mr. Bernheim sketches the history of the ballot in New York, and argues for the Australian System. Professor Woodrow Wilson analyzes and criticises Bryce's "American Commonwealth." The June number will contain an article by Professor Sloane of Princeton, editor of the *New Princeton Review*, and will continue and bring down to the 1st of May the "Record of Events" heretofore published in the *New Princeton Review*.

—W. J. Schofield, 105 Summer Street, Boston, Mass., has published "Political History since 1815 (excluding the United States)." This syllabus of lectures upon modern political history, prepared originally for use in the Massachusetts Institute of Technology, by C. H. Levermore, assistant professor of history, and D. R. Dewey,

assistant professor of economics and statistics, presents a skeleton of nineteenth century history down to 1889, and is based on copious references to standard works, and to important articles in the leading reviews.

— John Delay, New York, calls attention to the fact that the volumes in his new library of Gleanings from Foreign Authors are to be published at 30 cents, instead of 50 cents as previously advertised.

— Apropos of the arrival in the American market of his "Souvenirs d'un Homme de Lettres," it is said that Daudet is suffering from a hopeless nervous malady of the kind which wrecked Heine's life, and it is feared he may not be able to accomplish much more work.

— Mr. Ivan Panin, Wellesley, Mass., will print his lectures on Russian literature, delivered before the Lowell Institute, Boston, in a style uniform with his translations from Pushkin, as soon as he procures enough subscribers at \$2 per volume. Names should be sent to the above address before April 1.

— *The Publishers' Weekly* announces that Mr. Samuel C. Eastman of Concord, N.H., while spending the summer in Denmark, translated, under the author's encouragement and supervision, Dr. George Brändes' "Impressions of Russia." Dr. Brandes was invited to deliver a course of lectures in French before the literary clubs of St. Petersburg and Moscow, and while there he was given remarkable facilities for studying the people and institutions of the country. His views are extremely lively and entertaining, and his frankness of criticism is so pronounced that the book was placed on the black list by the censor. The chapters on Russian literature are fresh and full of information, and the work is a decided addition to our knowledge of an extraordinary country. Mr. Eastman's translation will be shortly published by T. Y. Crowell & Co.

— The *Forum* for March begins its new volume with an article by Cardinal Manning, showing the evils of compulsory education, and opposing the reading of the Bible in the public schools. Dr. George P. Fisher of Yale University will write a refutation of Cardinal Manning's conclusion. A paper by Professor W. S. Scarborough, a negro, will explain the aspirations and hinderances of the negro in the South.

— Peter Paul & Brother, Buffalo, will publish immediately "The Champions of Agrarian Socialism, and their Teaching," from the German of the Rev. V. Cathrein, S.J.

— Brentano Bros. announce that they will publish shortly "Where the Trout Hide," giving a detailed description of a newly opened, easily accessible, and beautiful country, whose waters teem with brook trout, black bass, and land-locked salmon, by Kit Clarke, an angling enthusiast.

— It is said that Mr. Du Chaillu's book on the Norsemen has practically been reset for the sixth time, the author having made discoveries and revisions which involve important changes and additions. The whole work, which has 1,200 beautiful illustrations, will probably appear next month.

— A volume which promises to be of interest to Scotsmen and their descendants in this country will shortly be issued from the office of the *Scottish American*, New York. It contains a series of essays illustrative of Scottish life, history, and character, gathered together under the title of "Scotland and the Scots." The author, Mr. Peter Ross, has long been a diligent student of the history of the Scottish race on this side of the Atlantic; and in the opening essay, "The Scot in America," is given a succinct account of how the people of that nationality have aided in all the religious, military, educational, national, political, and other movements which make up the history of North America. Among the other essays are "The Scot Abroad," "Scottish Characteristics," "Scottish Sports," "Scottish Superstitions," and "Freemasonry and Robert Burns."

— J. B. Lippincott Company have in press the third revised and rewritten volume of "Chambers's Encyclopædia," which will be complete in ten volumes; a "Life of Henry M. Stanley," by Rev.

H. W. Little; and "Examples, Rules, Tables, and References" for engineers, etc., by John Richards (subscription). They will also add to their medical list a "Cyclopædia of Diseases of Children," edited by Dr. J. M. Keating, to be in four volumes, sold by subscription; a new edition of the "Elementary Treatise on Human Anatomy," by Professor Joseph Leidy; "The Clinical Diagnosis of Non-Surgical Diseases," by Dr. Rudolf von Jaksch of Vienna, translated by Dr. Cagney of London; and a fifth volume in their "Practical Lessons in Nursing," devoted to "Diseases and Injuries of the Ear."

— A. Flanagan, 185 Wabash Avenue, Chicago, has issued a game of cards entitled "Literary Whist, or, Games of Great Men," prepared by N. O. Wilhelm. In playing the dozen or more games that may be played with these cards, it is expected that one may soon become acquainted with the lives, the works, and the characteristics of the world's greatest poets, prose writers, statesmen, warriors, scientists. Most of the games are simple enough for a child, or may be made abstruse for the learned. The set consists of 100 cards, $3\frac{1}{2} \times 2\frac{1}{4}$ inches. There are 26 "books" to be made or obtained. These are of poets, indicated by key-word P.; prose writers, key-word P.W.; soldiers, So.; statesmen, St.; scientists, Sc. Contemporaries of the same class are in the same book. Prominent traits and works are given with each name, so that in playing these games one acquires valuable knowledge while passing away a pleasant hour.

— Dr. H. A. Hare of the University of Pennsylvania has issued through P. Blakiston, Son, & Co., Philadelphia, his essay on "Mediastinal Disease," to which the Medical Society of London awarded the Fothergillian medal for 1888.

— Henry Worthington, 88 Liberty Street, this city, announces that he will furnish free, upon application, a handsomely illustrated catalogue descriptive of steam-pumps, pumping-engines, and hydraulic machinery.

— We learn from *Engineering* that the long-continued experiments which have been conducted on board the "Nettle" at Portsmouth, with the view of determining the respective merits of compound armor and of solid steel armor as a protection for battle-ships, have just been brought to a close. Only two Sheffield manufacturers sent in compound samples for competition; but the number of steel plates forwarded for trial amounted to eight, from as many makers, being two less than were expected. The ten-inch plates were attacked by steel and Palliser projectiles, at a range of thirty feet; and although two of the solid steel armor-plates, at least, underwent the crucial ordeal with satisfactory results, the superiority remained with the steel-faced armor now adopted in the English Navy.

— In experiments recently made in France on the elasticity of cork, it was found that disks of that substance, when submitted to a pressure of 1,100 kilograms per square centimetre, were compressed to one-fifth their thickness, and recovered their original dimensions in exactly ten minutes after the pressure was removed.

— The announcement recently made, that Professor Kruss of Munich had succeeded in decomposing nickel and cobalt, proves to be erroneous. What he has really done is to obtain from these two elements a third one, which existed in them as an impurity.

— In the March *Atlantic*, history is possibly the strong point, there being a paper on those two brave Scots, "The Keiths," by Hope Notnor, and one of Mr. Fiske's papers upon "Ticonderoga, Bennington, and Oriskany." Mr. Frank Gaylord Cook writes an article upon "Some Colonial Lawyers and their Work;" while a theme of a more recent day is treated in "Personal Reminiscences of William H. Seward," by Samuel J. Barrows, and his wife Isabel C. Barrows. The paper is especially interesting, since Mr. Barrows was private secretary to Mr. Seward, and Mrs. Barrows also acted temporarily in the same capacity. In this connection, Stuart F. Weld's consideration of "The Isthmus Canal and our Government" should be mentioned, and a review of Professor Bryce's book on "The American Commonwealth." Mr. James's serial, "The Tragic Muse," abounds in studies of personality, and Mr. Hardy's "Passe Rose" is interesting. The first part of a negro story called

"Hannah Calline's Jim," and an essay on "Simplicity," by Charles Dudley Warner, close the prose articles; and the poetry includes Mr. Whittier's "The Christmas of 1888," and verses by E. Wilson.

LETTERS TO THE EDITOR.

*.*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

The Soaring of Birds.

SINCE my paper was reported in *Science* (xii. p. 267), Messrs. Oliver, Pickering, and MacGregor have favored the journal with letters on the subject.

Professor Oliver (xiii. p. 15), while admitting that the action I suggest is to some extent efficient in sustaining the bird, questions its sufficiency. I had asked the same question myself, and found no answer; but I am glad to know, through private correspondence, that Professor Oliver and at least one other physicist are disposed to put the question to nature through experimentation.

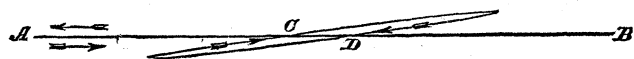
Professor Oliver also suggests minute vibratory motions of the wings, or perhaps of the individual wing-feathers, and cites an observation by another. The same hypothesis was advanced in explanation of the allied phenomenon of hovering, but was rejected on the strength of what seemed sufficient observation (*Nature*, viii. p. 324; ix. p. 5). The hovering bird remains in one place for so long a period that he can be deliberately and carefully watched.

Mr. Pickering and Professor MacGregor each proposes an explanation different from mine, and not involving differential air movements, but appealing instead to a homogeneous and uniform wind. Their conception of relative velocities is so different from mine, and I am so confident in the correctness of my own, that I am led to suspect I have not made my meaning clear, and I therefore ask the privilege of restatement.

As I conceive the matter, the horizontal velocity of the bird with reference to the earth has no importance, and should be ignored. The earth enters the problem only by means of its attraction. Except for the gravitational pull, we need not consider the bird in relation to any thing except the air. If a cloud intervened between the bird and the earth, so that he could not see the ground, he would not know in which direction the air surrounding him was passing over the earth; but the possibility of his soaring would not be affected by that ignorance. Provided the air in which the bird floats is not disturbed thereby, his motions would not be affected by the sudden reversal of the direction of rotation of the earth, although such a reversal would enormously change the relative velocity of bird and earth.

In my analysis of the subject I spoke of winds, that is, currents of air moving horizontally with reference to the earth, because such language afforded me a simple means of expression, and for that reason only. In so doing I took a special case as illustrative of the general case. As this seems to have been misunderstood by some of your correspondents, I will repeat the analysis in more general language.

Let the line AB represent in section a horizontal plane within the atmosphere. Conceive the body of air above this plane and the body of air below it to have different motions, such that their differential motion has the direction indicated by the arrows; that is



to say, the upper body referred to the lower moves from B to A , or the lower body referred to the upper moves from A to B . The movement of the two bodies collectively may be in any horizontal direction. They may both move toward A , the upper moving the swifter. They may both move toward B , the upper moving the slower. Either may be still and the other move past it, or they may move in directions approximately normal to the paper. My only postulates are, that their motions have no vertical component, and that their differential motion, z , has the direction expressed by the arrows.

The oval curve represents the assumed orbit of the bird as presented to an eye nearly in its plane. The bird ascending on one side of this orbit through the point C has, just before reaching that point, a velocity V as referred to the lower body of air, in which it is then moving. Immediately after passing C , his velocity referred to the upper body of air, in which he is then immersed, is $V + z$. He moves faster in the upper air, because when he enters it his direction is opposed to the direction of the differential motion of the upper air referred to the lower. His absolute motion both before and after passing the plane of separation is the same; but his relative velocity, that is, his velocity referred to the air through which he is passing, has been increased by the quantity z . Continuing on his circling orbit, he first ascends and then descends, reaching the plane of separation at the point D . While he ascends, gravity retards his motion; while he descends, his motion is accelerated by gravity to the same extent; so that he returns to the plane at D with the same velocity ($V + z$) with which he left it at C . He now passes from the upper body of air to the lower body in such direction that he again increases his relative velocity. As soon as he has passed D , his velocity referred to the lower air is $V + 2z$. Continuing to C , he first descends and then ascends, his velocity being first accelerated by gravitation, and then retarded by the same amount; so that he reaches C with the velocity $V + 2z$, in place of the previous velocity V , having gained the velocity $2z$ by passing in suitable directions to and fro between the differentially moving bodies of air.

The various qualifications of this theorem, and its relation to the problem of soaring, need not be repeated here. All that is now attempted is to show that the essential parts of the analysis are absolutely independent of the direction and velocity of air movement as referred to the ground.

It appears to me that Mr. Pickering and Professor MacGregor, by referring the motions of the bird partly to the ground and partly to the air, engender confusion, and are led to assume untenable positions. Mr. Pickering (xiii. p. 31) says that a piece of paper floating on the air is carried along horizontally with the velocity of the wind, but that a soaring bird does not drift so fast. Then, to account for the floatation of the bird, he appeals to the "force exerted on him by the wind, owing to the fact that he does not move along as fast as the surrounding air." Thus he assumes a force tending to prevent the bird from drifting horizontally with reference to the earth; and this assumption reduces the problem to practical identity with the problem of the ascent of a boy's kite. In point of fact, the assumed force does not exist: the only re-action between the bird and the earth is through gravity, and the direction of gravitation is vertical. If it be true that the soaring bird drifts less rapidly than the piece of paper, the explanation lies in something that the bird does; and that thing, whatever it is, costs energy. Appealing to the bird's net movement against the wind as a source of energy merely shifts the point of difficulty, for his net movement against the wind must then be explained.

Professor MacGregor says, "Let us suppose, now, that a bird is at any instant moving horizontally, in the same direction as the wind, and with a small velocity relative to the earth. . . . As his speed increases, the velocity of the wind relative to him diminishes" (xiii. p. 152). Now, if the velocities of bird and wind relative to the earth are so related that increase of the bird's speed diminishes the velocity of the wind relative to him, then it must be that the wind is moving faster than the bird, or is overtaking him. The context shows that Professor MacGregor conceives the bird to face in the direction toward which the wind blows, and it follows that with reference to the air the bird is moving tail first. I am confident that no ornithologist will admit the possibility of such flight; and its implicit postulation could hardly have occurred had the problem been stated wholly in terms of bird and air instead of being stated partly in terms of bird and ground. A little further on he says, "Let us suppose that in wheeling he maintains his velocity relative to the earth as well as his elevation. Then [after wheeling], starting upwards with a considerable velocity, he will clearly be able to rise through a certain height before his velocity has been reduced to its initial value." The assumption that the bird in wheeling maintains his velocity relative to the earth

appears to me absolutely groundless. The only velocity that can possibly remain constant, or approximately constant, during wheeling, is the velocity with reference to the supporting medium; and as that velocity is, according to his previous assumption, not only small, but negative, there is no energy available to enable the bird to rise. Indeed, the bird, in passing from a negative velocity relative to the air, to a positive velocity relative to the air, must pass through the phase of no velocity relative to the air, in which he is practically helpless, being compelled to fall vertically in order to acquire sufficient speed to steer. Like Mr. Pickering, Professor MacGregor treats the subject as though the earth influenced the motions of a bird on the wing by some other means than gravitational attraction. He apparently fails to perceive, that, if the body of air in which the bird moves has no internal motion, its relation to his flight is precisely that of a calm.

Let me illustrate. A steamer propelled with uniform force on a calm ocean has its rudder turned constantly, and by the same amount, to the right, and consequently describes a circle. This circle is described *on the ocean*: it expresses a relation between the moving body and that by which it is supported. It has no reference to the bottom of the ocean. It makes no difference whether that part of the ocean is at rest or is part of a swift current. The relation of the boat to the water is not affected by the relative motion of water and bottom. Or consider a skater. Having acquired momentum, he is able to describe circles without propulsive effort until the stored-up energy is consumed by friction and by the resistance of the air. The ice on which he circles may be frozen to the shores of a pond, or it may float with uniform speed on a rapid river; but his relation to the ice is the same in either case, and his circles have the same pattern *as engraved on the ice*. The case of the soaring bird is closely analogous. His horizontal motions are related only to the air in which he moves, and by which he is supported, and they are not affected by the uniform horizontal motion of that air with reference to the ground.

A slight correction, and I have done. I assume, as Professor MacGregor says, that after wheeling, the bird's velocity relative to the medium in which he turns will be the same as before (discounting friction); but I do not admit the implication "that during the turn his velocity relative to the earth will change by an amount equal to twice the velocity, relative to the earth, of the medium in which the turn is made." His velocity relative to the earth will change by an amount equal to twice his velocity relative to the medium.

G. K. GILBERT.

Washington, D.C., Feb. 25.

IN two communications published in the last number of *Science* (p. 151) under the above title, Professor Pickering and Professor MacGregor have developed with considerable ingenuity a theory of the possibility of a bird soaring in a uniform horizontal wind; but it is certainly true that a bird cannot soar — that is, permanently sustain or elevate itself without expending energy — in such a wind, and it has therefore seemed to me to be important, in the interests of clear thinking, to show on dynamical grounds why soaring is impossible in this case.

Evidently the velocity of the wind relative to the earth has nothing to do with the question, as it is the relative movement of wind and bird that causes the re-actions between them, and therefore can alone come into consideration. Let the air, therefore, be supposed to be at rest relative to the earth, and it becomes at once obvious that the bird cannot soar: for, suppose the bird to have any imaginable initial velocity, and to wheel in the most artful manner, it is still a mass falling under the influence of gravity, and only resisted more or less by the fluid friction of the medium in which it is placed. This fluid friction of the air against its wings can only delay its fall, but can never prevent it, just as it delays the fall of a feather.

A theory of soaring must explain how energy is given to the bird by the wind; but it is clear, that, instead of the bird receiving energy, it is expending either its kinetic energy, as when in one of its whirls it sweeps upwards, or potential energy when it sweeps downwards. But the temporary increase of potential energy in a rise can never equal the corresponding loss of kinetic energy, because energy is being continually expended in frictional heating. There is thus a steady expenditure of energy, and none received

from the medium, and the bird is therefore bound to come to the ground. The only effect of the medium is to resist the motion, in whatever direction it may take place, whether up or down.

As soon as it is clearly seen that the only thing we are concerned with is the relative motion of air and bird, and that the air may be at rest relative to the earth without affecting the question in the slightest, the futility of any attempts to explain soaring in a uniform horizontal wind is apparent.

If any one wishes to discover the particular fallacies in the theories above mentioned, let him attempt to follow out the reasoning as given in the communications referred to; assuming, however, that there is no wind, that the air is at rest relative to the earth; remembering that the mere fact of the earth's moving relative to the wind has no connection with the relation between the bird and the air.

The theory that soaring can be kept up by taking advantage of differentially moving layers of air is not open to the above criticism, and may be the true explanation: it is certainly not unreasonable on its face.

ARTHUR L. KIMBALL.

Johns Hopkins University, Baltimore, Feb. 23.

To keep Water-Mounts Moist.

IN biological work with the microscope it is frequently desirable to preserve water-mounts for several days, that growth, development, etc., may be observed from time to time. Water lost by evaporation can be very successfully replaced to the glass slips from a beaker beneath by means of capillary tubes. To make these, hard-glass tubing of about three millimetres bore is softened in a Bunsen flame, and then drawn out to a diameter of from two-tenths to three-tenths of a millimetre. This is then divided up into lengths of five centimetres, and each piece bent at an angle of about 80° one centimetre from an end by holding it over a very small flame for an instant, when, of its own weight, the end falls to the proper angle. One tube is sufficient for a slip, and is applied by first touching the longer limb in water, when instantly the liquid will rise and fill the tube, which may now be suspended by the shorter portion from the glass slip, allowing one end to just touch the edge of the cover-glass, and the other to dip beneath the surface of the water in the beaker. A thin film of water will run along the shorter limb, and hold it securely in place. The whole is then covered with a suitable bell-jar. In this way mountings in water or nourishing solutions may be kept an indefinite time, and are always ready for examination without disturbing them in the least. Should it be desired to supply more fresh water or nourishing solution to the mount than would ordinarily arise, a bit of filter-paper applied to the side of the cover-glass opposite the capillary tube will accomplish this.

E. B. KNERR.

Parsons College, Fairfield, Io., Feb. 18.

Color-Blindness a Product of Civilization.

THE following is a summary of a paper read before the Kansas Academy of Science at Leavenworth, Nov. 1, 1888: —

The fact that blindness to certain colors exists among civilized people is well established; also the percentage of cases to be found among males has been determined with considerable probability for the races of Europe and America. There has been much diversity in methods of testing, and the results of many reported determinations might well be called into question. Still it is probably not far from the truth that about four out of every hundred males are more or less deficient in color-sense. Of females there have been reported (B. J. JEFFRIES, M.D., *Color-Blindness*, p. 74) as examined in Europe and America 39,828; and of these, only 60 were color-blind, or 2 per cent. Of both males and females, 156,732 have been tested; and of these, 6,721, or 4.27 per cent, are color-blind. These statistical facts have naturally excited interest and discussion. If so large a number as four out of every hundred are unable to distinguish colors, there arises, of course, a practical question important to the railroads, marine, etc.

The gravity of this fact is already recognized more or less in all countries by the test examinations for color-blindness among employees. But there is in these statistics also much of interest to scientists.

Most cases of color-blindness are found to be congenital, and are incurable. Many have been produced by disease, some by violent concussions in accidents, and some by excessive use of tobacco and alcohol. Temporary blindness to violet may be induced by santonine. From these facts several interesting questions have suggested themselves to us. If color-blindness follows the law of heredity, is it on the increase, or decrease? Further, is it a product of civilization? The first of these queries can be answered only by statistical data extending over long periods of time. The second naturally suggests a comparison, first, of the color-sense of civilized nations among themselves; and, second, of civilized with uncivilized peoples. Of tests in native tribes, we can find but two recorded, — those of Dr. Favre on some tribes in Algiers, and those of a Dr. Fox on 150 American Indians, but where we do not know.

First, for the comparison of civilized tribes among themselves, we have calculated the following percentages from tables reported by Dr. Jeffries: —

	No. Examined.	Per Cent Color-blind.
Austria.....	5250	3.79
Denmark.....	5840	3.74
Belgium.....	8106	4.13
Holland.....	2300	1.43
Finland.....	1200	5.00
Norway.....	205	4.88
Sweden.....	32504	3.73
Switzerland.....	3024	5.36
Germany.....	6344	4.12
Russia.....	12830	3.30
Italy.....	2065	2.32
England.....	16431	3.75
United States.....	44844	3.64
Average per cent		3.76

No great reliance can be placed upon these results. The numbers examined are too small, the methods of testing not uniform, not equally reliable. However, the probabilities of error are about equally distributed; so that the conclusion is fairly well established, even without great accuracy of data, that among civilized nations color-blindness is at present almost equally common.

Second, among uncivilized people, Dr. Favre's results from Algiers, already alluded to, show 414 examined, and only 2.6 per cent color-blind. Dr. Fox reports 161 young Indians tested, and only 1.81 per cent color-blind. These percentages, so low compared with those for civilized people, suggested to us that color-blindness may be a product of civilization, and have led to our tests here reported. At the Haskell Institute at Lawrence, Kan., are several hundred Indians, representing many tribes. These we have recently examined by Holmgren's method with Berlin worsteds. Out of 418 tested, — 285 males and 133 females, — only three cases of color-blindness exist, or only .7 of one per cent. These three are full blooded Indians of the Pottawattamie, Pawnee, and Crow tribes. Of these, two have defective color-sense for red, and one for green.

The Indians of the school are about equally divided as full-bloods and half-breeds. It seemed to us that the half-breeds showed more instances of blunted color-sense than the full-bloods. This was evidenced in more frequent and prolonged hesitation among them in comparing the colors than among the full-bloods. If this be confirmed by more extended examinations, it would, in conjunction with the low percentages obtained as above, be an argument in the theory proposed by us that defective color-vision is in some way the product of civilization.

The use of tobacco suggests itself as a possible cause. This would explain also the low percentage among females. It leads also to the thought of increase of color-blindness in males in future

generations. But the data are at present too meagre to more than suggest this explanation.

It is certainly not accidental that nearly every case of color-blindness is for red, few for green, and seldom one for violet. Why are the defects thus limited, at present at least, to the longer wavelengths of light?

The Young-Helmholtz theory of color-perception will locate the affection in that layer of the retina corresponding to the first of the three primary sensations of color. But why this special layer, with few exceptions, is the only one affected, has at present no explanation.

The law of heredity indicates increasing sensitiveness in those nerves which are subjected to special use through many generations. It seems reasonable to look for an explanation of the more perfect color-sense in females to this fact; but among males there will probably be an increase, in future generations, of the number of cases of defective color-sense.

L. I. BLAKE.

W. S. FRANKLIN.

Lawrence, Kan., Feb. 19.

Note on the Wind-Pressure Constant.

THERE is a very old formula in use among English and American engineers and meteorologists for obtaining the force of the wind from its velocity. The product of the square of the wind's velocity in miles per hour into the factor .005 is taken as the pressure in pounds upon each square foot. It is used alike at sea-level and on the tops of high mountains, and in the extreme temperatures of winter and of summer, notwithstanding the pressure must vary as the density of the air. This is the value of the factor determined by Rouse from experiment about one hundred and fifty years ago, and of all the crude experiments which have been made from that time to this, and before. It seems to be an extreme value. Of a number of the older determinations of this factor, it is stated, in Gehlér's "Physicalische Wörterbuch," that this is the worst, while those of Hutton and Woltman are perhaps not much in error. It is astonishing to see, therefore, with what tenacity engineers and meteorologists still hold on to this factor. It has been maintained by the writer for several years that this factor is much too large, — first in *Van Nostrand's Journal*, 1881; then in "Recent Advances in Meteorology;" and in the *American Meteorological Journal*, 1887. It was shown that the theoretical value of the factor, not considering friction, is .0027; and it was thought that this could not possibly be increased to .005 by the friction of the air. And it was shown that this view of the matter is confirmed by Loomis's results obtained from the discussion of experiments made by the request of Newton in St. Paul's Cathedral, London, upon the velocity of the falling of hollow glass globes and of bladders, and of Hutton's experiments with a whirling-machine. From all these researches, and also the somewhat recent experiments of Hazen with a whirling-machine, it was concluded that the theoretical constant above could not be increased by friction more than one-tenth, or, at most, one-eighth part. But the old factor has been in use so long, that conservatives think it must be correct, and so are unwilling to give it up.

A further confirmation of the erroneousness of the factor is now found in the last number of the *Quarterly Journal of the Royal Meteorological Society*, which contains a report from the wind-force committee appointed by that society. The committee, as yet, have made only a few preliminary experiments in this part of their work; but the average value of the factor from these is .003, which is about one-tenth part greater than the theoretical value given above. This will, no doubt, be changed a little in their final report, after more experiments shall have been made; but as it agrees nearly with the factor obtained by Hazen, and with what is to be inferred from other experiments, it is not probable that the final result will vary much from this.

This is a factor in which engineers are especially interested, and its value ought to have been accurately determined by them long ago; but, as the Royal Meteorological Society has now taken it in hand, it is to be hoped that its committee will do the work thoroughly, as they apparently intend to, and determine the value of this factor accurately, not only for plates of different sizes and shapes, but also for different temperatures and barometric pressures.

WM. FERREL.

Kansas City, Mo., Feb. 20.

Publications received at Editor's Office, Feb.
17-23.

- ALDEN's Manifold Cyclopaedia of Knowledge and Language. Vol. XI. Debt to Dominic. New York, J. B. Alden. 122 p. 50 cents.
- BINET, A. The Psychic Life of Micro-organisms. Tr. by Thomas McCormack. Chicago, Open Court Publ. Co. 120 p. 12^c. 75 cents.
- BUNNER, H. C. A Woman of Honor. (Ticknor's Paper Series, No. 52.) Boston, Ticknor. 336 p. 16^c. 50 cents.
- FOLIE, F. Annuaire de l'Observatoire Royal de Bruxelles, 1889. Bruxelles, F. Hayez. 425 p. 24^c.
- GOSSE, E. A History of Eighteenth Century Literature (1660-1780). London and New York, Macmillan. 415 p. 12^c. \$1.75.
- HAWTHORNE, N. Tales of the White Hills, and Sketches. (Riverside Literature Series, No. 40.) Boston and New York, Houghton, Mifflin, & Co. 95 p. 16^c. 15 cents.
- IVES, F. E. A New Principle in Heliochromy. Philadelphia, The Author. 13 p. 8^c.
- JACKMAN, W. S. Practical Lessons on Plants. Boston, N. E. Publ. Co. 53 p. 16^c.
- LEVERMORE, C. H., and DREWY, D. R. Political History since 1815 (excluding the United States). Boston, W. J. Schofield, Pr. 116 p. 8^c. \$1.25.
- LITERARY Companion, The. Vol. I. No. 1. Kansas City, Kan., W. H. Plank. 4 p. 4^c. 25 cents per year; single number, 3 cents.
- LUCAS, C. P. A Historical Geography of the British Colonies. Vol. I. Oxford, Clarendon Pr. 191 p. 12^c. \$1.25.
- PILLING, J. C. Bibliography of the Iroquoian Languages. Washington, Government. 208 p. 8^c.
- PRECKE, W. H., and MAIER, J. The Telephone. London, Whittaker & Co.; New York, VanNostrand. 498 p. 12^c. \$4.
- PREYER, W. The Mind of the Child. Part II. The Development of the Intellect. Tr. by H. W. Brown. New York, Appleton. 317 p. 12^c.
- SMITH, C. L. The History of Education in North Carolina. Washington, Government. 179 p. 8^c.
- WINCHELL, A. Shall We Teach Geology? Chicago, S. C. Griggs. 217 p. 12^c. \$1.

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